

M
no. 42
922
pp. 2
BULLETIN IV

Dr. B. C. ...
VOLUME II

REPORT OF THE THIRD ANNUAL MEETING

OF

THE AMERICAN ASSOCIATION OF SOIL SURVEY WORKERS

HELD IN

UNION BUILDING, UNIVERSITY OF ILLINOIS

URBANA, ILLINOIS

NOVEMBER 17 & 18, 1922

THE LIBRARY OF THE
FEB 23 1938
UNIVERSITY OF ILLINOIS

Report Issued From The Office Of The Secretary,
Department Of Farm Crops & Soils, Iowa State College,
Ames, Iowa,

March 1923

Handwritten text, possibly a signature or name, located at the top left corner of the page.

631.06
AM
no. 42
copy 2

TABLE OF CONTENTS

Report of The Committee on Soil Color Standards-----	89
The Need of Color Standards for use in the Field-----	96
Report of the Committee on Publicity and Information-----	97
Report of the Committee on Improvement of Soil-----	102
Maps and Reports	
The Improvement of Soil Survey Reports-----	104
Report of the Committee on Correlative Laboratory Work-----	107
Report of the Committee on the Future Field of the Soil Survey	
Workers Association-----	111
Report of the Committee on the Classification of Organic Soils----	113
Some Suggestions Regarding Soil Survey Reports and the Soil Survey-	115
Soil Survey Reports-----	123
The Relation Between Soil Type and Chemical Composition-----	130
The Classification of Soils for Commercial Purposes-----	150
Soil Studies in Michagan-----	159
The Condition of Soil Survey Work in Russia Toward the Beginning of	
the Year 1923-----	166
Progress of Soil Survey in Ontario-----	170
Secretary's Report-----	171
Treasure's Report-----	172
Minutes of the Business Meeting-----	173
Members and Friends Attending 1922 Conference, Urbana, Ill.-----	178

THE LIBRARY OF THE
FEB 23 1938
UNIVERSITY OF ILLINOIS

Report of the Committee on Soil Color Standards.

J. Gladden Hutton, In Charge of South Dakota Soil Survey.

The Committee on Soil Color Standards was invited by Dr. Whitney, Chief of the Bureau of Soils, to meet in Washington and to make use of the soil collection of the Bureau. The first meeting occurred March 28, 1922, and the sessions continued for five days.

In the report of this Committee at the Lansing meeting last November it was suggested that if standard color disks were available it would be possible to duplicate any given soil color and to record the color factors involved in such duplication. However, the Bureau of Standards has not selected colors of a standard value which may be used. A beginning has been made in the criticism of the color systems of Ridgway and Munsell and in connection with the Munsell Company work has been started in the direction of the standardization of colors.

The Committee had hoped to be able to get a set of standard colors printed in a convenient form for field use. One of the principal engraving companies which has done much fine color work had the matter under consideration, but just before the meeting of the Committee declined to attempt the work. Another company had expressed a willingness to undertake the printing of a set of colors based on a color system that will meet the requirements of the Bureau of Standards. This company, however, is not yet ready to bring out its system. The Committee, therefore, temporarily laid aside the plan of getting colors printed. The plan of producing colors by whirling Maxwell disks, as proposed by the chairman, was also temporarily abandoned for the reason that no standard disks are available.

The Committee was then left with the problem of providing a temporary set of samples to be used by field men. From the thousands of samples in the collection of the Bureau of Soils about 300 were selected which included almost every distinct soil color. From these about 80 were finally selected as sufficient to cover the range of common soil colors. In order that it might be possible to refer these colors to some standard, Ridgway's "Color Standards and Color Nomenclature" was to be used as a reference and all colors selected have been compared with the Ridgway colors and the Ridgway color-name and number have been attached.

In Table No. 1 the names of the common soil colors as usually understood appear in the first column; the collection numbers appear in the second column; while Ridgway's numbers and color names are found in the third and fourth columns respectively.

The colors listed in Table No. 1 were arranged into 32 groups, as indicated, and from each of these groups one sample was taken which in the opinion of the Committee was most representative, and it was usually the mean or average color of the group. These groupings and selections were made separately by members of the Committee as well as by other soil surveyors who

were called in, so that they do not represent the ideas of any one individual.

The Committee planned to prepare sets in small bottles for field use. When the plan was presented to Dr. Whitney by Mr. Rice after the Committee adjourned, he suggested that an experiment should be made of pressing the samples into small briquettes. The Bureau of Soils had a press which could exert a pressure of 2,500 pounds to the square inch, and could by slight modification be adapted to this purpose. From a mechanical standpoint the experiment was a success. With the exception of pure, or almost pure, sands and silts, soils may be made into briquettes which will withstand ordinary usage. Even the sands may be made into briquettes by supplying a filler of clay or other cementing material. A slight change of color or shade is brought about by pressing the sample resulting, as a rule, in a somewhat darker or duller color. This can be provided for by choosing brighter colors in order to get the desired shade after compression. After the proper colors are secured a sufficient number of sets may be made up to supply field men. The change in colors on compression are indicated in Table No. 3, Mr. Rice having made the comparisons with the original samples.

If the briquettes are protected by Riker mounts like the one exhibited and care is taken in selecting clear white glass for the cover, much of the color comparison work may be done without exposing the briquettes. In some cases it may be necessary to remove the glass for satisfactory comparison.

It is true that the selection of colors by the method followed by the Committee is somewhat arbitrary and unscientific, but owing to the present status of the color standard problem, no better method seemed available. An attempt has been made to select a set of colors for use in the field which would bring about greater uniformity than we have in soil color descriptions at the present time. No doubt there will be a demand for a more extensive list. The proposed list can, of course, be enlarged by adding intermediate colors.

The color names used are also somewhat arbitrary and are somewhat of a compromise between the common name and the true color as designated by Ridgway. However, the Ridgway equivalent has been recorded in each case so that the proposed color system may be compared with any standard color system which may be evolved.

The Committee has tried to avoid such commonly misused terms as drab, chocolate, etc.

The present report should be regarded as tentative.

Respectfully submitted,

J. Gladden Hutton, Chairman
Thomas D. Rice
A. M. O'Neal.

Table No. 1.

Soil Colors Selected from the Collection of the Bureau
of Soils, U. S. Department of Agriculture.

(Colors marked "#" have been selected and samples prepared for field use)
(See Table No. 2.)

Soil Color	Soil No.	Ridgway's No.	Ridgway's Color
# White	261918	None	White
# Grayish white	16493	None	None
Light gray	28377	17""d	Drab gray
# Light gray	322911	21""d	Olive buff
# Gray	332310	17""d	Drab gray
Gray	14224	17""b	Light drab
Dark Gray	28383	21""d	Smoke gray
# Dark gray	28387	15""i	Mouse gray
Dark gray	372830	17""i	Hair brown
Cream color	422410	21""f	Ivory yellow
Cream color	24345	19""f	Cartridge buff
# Light grayish yellow	234021	19""f	Cream color
# Light grayish yellow	234522	19""d	Cream buff
Light grayish yellow	211507	17""d	Warm buff
Yellow	24346	17f	Pale orange yellow
# Yellow	415322	19""h	Chamois
# Orange	28575	15""i	Ochraceous tawny
# Yellowish brown	181918	17""i	Tawny olive
Yellowish brown	25068	17""b	Cinnamon-buff
Brown	190317	17""i	Tawny olive
Brown	29092	19""i	Isabella color
Brown	130217	17""i	Buffy brown
Light reddish brown	422110	17""	Cinnamon
Light reddish brown	414424	17""i	Sayal brown
# Light reddish brown	421936	15""	Cinnamon
# Reddish brown	201029	17""b	Avellaneous
Reddish brown	242451	17""i	Tawny olive
# Reddish brown	423613	15""i	Sayal brown

Table No. 1 (Cont.)

Soil Color	Soil No.	Ridgway's No.	Ridgway's Color
# Reddish brown	253276	13'i	Tawny
Reddish brown	254601	17k	Antique brown
Dark brown	5509115	15"k	Snuff brown
# Dark brown	5509114	17"k	Saccardo's umber
Dark brown	550903	17"'i	Buffy brown
Dark grayish brown	28712	17"'i	Buffy brown
# Dark grayish brown	28666	17""	Drab
Dark grayish brown	371025	17""	Drab
Dark grayish brown	332180	17""	Drab
Dark grayish brown	28687	17""	Drab
Very dark grayish brown	28639	17""i	Hair brown
Very dark grayish brown	28679	13""k	Fuscous
Very dark brown	444981	15"m	Bister
Very dark brown	372001	17""k	Olive brown
# Very dark brown	444905	17"k	Saccardo's umber
Very dark brown	22408	13""k	Fuscous
Black	261362	9""k	Dusky drab
Black	333743	15""i	Deep mouse gray
# Black	331829	13""m	Fuscous black
# Olive gray	351794	21""	Dark olive buff
Olive gray	170564	21""	Grayish olive
Dark olive gray	22379	21""b	Light grayish olive
# Dark olive gray	22412	21""	Grayish olive
Mouse gray	370716	21""i	Deep grayish olive
# Mouse gray	321022	15""i	Deep mouse gray
# Yellow olive	16998	19"i	Isabella color
Yellow olive	170563	19'i	Old gold
Dark olive drab	170546	21"i	Ecreu olive
# Dark olive drab	170478	21"k	Buffy olive
Green	170547	25"k	Kronberg's green
# Light reddish yellow	414337	17"b	Cinnamon buff
Yellowish red	414338	15"b	Pinkish cinnamon
# Yellowish red	235504	11'b	Apricot buff
Red	416118	11'i	Cinnamon-rufous
# Red	22953	11'i	Cinnamon-rufous

Table No. 1 (Cont.)

Soil Color	Soil No.	Ridgway's No.	Ridgway's Color
Deep red	12697	9'i	Ferruginous
# Deep red	255712	11k	Sanford's brown
Deep red	44--Tex.	9k	Burnt sienna
Dark red	16328	9k	Burnt sienna
# Dark red	16327	11'k	Hazel
# Dark brownish red	255523	11m	Auburn
Purplish brown	312518	13''	Fawn color
Purplish brown	312517	17'''i	Buffy brown
# Purplish brown	4446127	13'''	Drab
Purplish brown	444695	13'''	Drab
Purplish brown	4446123	15'k	Cinnamon-brown
Grayish purple	22199	13''	Fawn color
# Grayish purple	211723	13''	Fawn color
# Purplish red	211724	9'i	Cacao brown
Purplish red	22429	13''i	Mikado brown
Purplish red	22428	13'm	Mars brown

Table No. 2.

List of Thirty-Two Soils Selected for Use in the Field.

Selected color No.	Soil No.	Usual Group Name. (Arbitrary)	Ridgway's Color Name	Ridgway's Number.
1.	261918	White	White	None
2.	16493	Grayish white	Grayish white	None
3.	322911	Light gray	Olive buff	21''d
4.	332310	Gray	Drab gray	17''d
5.	28387	Dark gray	Mouse gray	15''''
6.	234021	Light grayish yellow	Cream color	19'f
7.	234622	Light grayish yellow	Cream buff	19''d
8.	415322	Yellow	Chamois	19''h
9.	28575?	Orange?	Ochraceous tawny	15'i
10.	181918	Yellowish brown	Tawny olive	17''i
11.	201029	Reddish brown	Avellaneous	17''b
12.	421936	Light reddish brown	Cinnamon	15''
13.	423613	Reddish brown	Sayal brown	15''i
14.	5509114	Dark brown	Saccardo's umber	17''k
15.	28666	Dark grayish brown	Drab	17''''
16.	444905	Very dark brown	Saccardo's umber	17''k
17.	28679	Verk dark grayish brown	Fuscous	13''''k
18.	331829	Black	Fuscous black	13''''m
19.	351794	Olive gray	Dark olive buff	21'''
20.	22412	Darkolive gray	Grayish olive	21''''
21.	321022	Mouse gray	Deep mouse gray	15'''' 'i
22.	16998	Yellowish olive	Isabella color	19''i
23.	170478	Dark olive drab	Buffy olive	21''k
24.	414337	Light reddish yellow	Cinnamon buff	17''b
25.	235504	Yellowish red	Apricot buff	11'b
26.	22953	Red	Cinnamon rufous	11'i
27.	255712	Deep red	Sanford brown	11k
28.	16327	Dark red	Hazel	11'k
29.	255523	Dark brownish red	Auburn	11m
30.	444695	Purplish brown	Cinnamon drab	13''''
31.	211723	Grayish purple	Fawn color	13'''
32.	211724	Purplish red	Cocoa brown	9''i

Table No. 3.

Effect of Briquetting on Color of Sample.

Color No.	Soil Collection Number	Color of Loose sample	Color of Briquette.
1.	261913	White	White
2.	16493	Grayish white	Grayish white
3.	322911	Olive buff	Smoke gray?
4.	332310	Drab gray	Drab gray
5.	28387	Mouse gray	Mouse gray
6.	234021	Cream color	Cartridge buff
7.	234622	Cream buff	Cream buff?
8.	415322	Chamois	Chamois
9.			Ochraceous tawny
10.	181918	Tawny Olive	Tawny Olive
11.	201029		Avellaneous
12.	421936	Cinnamon	Cinnamon?
13.	423613	Sayal Brown	Cinnamon-Sayal Brown
14.	5509114	Saccardo's umber	Buffy Brown-Saccardo's UMBER
15.	28666	Drab?	Drab
16.	444905	Saccardo's umber	Sepia
17.	28679	Fuscous	Hair brown
18.	331829	Fuscous Black?	Chaetura Black
19.	351794		Light Grayish Olive
20.	22412	Grayish olive?	Grayish olive
21.	321022		Mouse gray
22.	16998	Isabella color	Isabella color
23.	170478	Buffy olive	Grayish olive
24.	414337	Cinnamon buff	Cinnamon buff
25.	235504	Apricot buff	Orange cinnamon
26.	22953	Cinnamon Rufous	Cinnamon Rufous
27.	255712	Sanford Brown	Hazel
28.	16327	Hazel	Auburn
29.	255523	Auburn?	Mars brown
30.	444695	Verona brown?	Natal brown
31.	211723	Fawn color	Wood brown
32.	211724		Fawn color

In the foregoing table the soil color number is given, then the collection number of the sample. Column No. 3 gives the Ridgway color-name determined in the loose sample; Column No. 4 gives the Ridgway color-name as determined from the compressed soil of the color-standard briquettes.

THE NEED OF COLOR STANDARDS FOR USE IN THE FIELD.

A. M. O'Neal, Iowa Soil Survey.

The present system of soil classification depends largely upon color. The official series descriptions furnished by the U. S. Bureau of Soils gives the colors and color limits of the various soil horizons and these in turn must be interpreted and applied by the field men. The task is rendered all the more difficult since soil conditions are variable. The moisture content which has a decided effect upon soil color is subject to wide fluctuations. Therefore it is doubtful whether the different field men will have the same conception of a given series description or whether the same man can consistently hold a given type within given limits during a season or from season to season.

Realizing these difficulties, work was started to see if the present system could not be improved to meet the demands. These investigations have not been carried far enough to justify any definite recommendation. It is deemed advisable, however, to outline the present scheme in hopes that it will stimulate interest and open up new lines of thought.

The soil colors picked out by the color committee to serve as a nucleus around which to build all future work are excellent. Still in their present form they are of little value to the field men. They require a set of color standards fixing the color limits of the various series. These standards should give both the color terminology and the actual colors of each horizon. The air dry sample would be ideal for comparison but soils are scarcely ever observed in this condition in the field. Since such is the case it would seem advisable to show the 3-foot soil section in an air dry condition and with 10, 20, and 30 per cent of moisture. The field man could then estimate the amount of moisture and by comparing with his table easily classify his soils. It should be much easier and more accurate to determine the moisture content than to estimate what color a soil containing say 20 per cent of moisture would be if in an air dry condition. The latter leaves too much to the imagination. The chance of error is much greater.

The character of the soil work requires that such a set of standards be compact and easy to carry at all times. Something small that can be slipped into the pocket. Vials of soil are excellent for use in the room but too bulky to handle. The reproduction of the 3-foot soil section in oils or water colors would prove most valuable. This would enable the standards to be prepared in the form of a small loose leaf book, say 3 inches by 6 inches. Each leaf could be devoted to a series giving not only the official series description but small plates showing the actual colors of the soil horizons in an air dry condition and with 10, 20, and 30 per cent of moisture. In this way only the series required at any time need be carried. The chief objection to this scheme is the reproduction of soil colors. However it is felt that this difficulty will soon be overcome. In fact it is not unreasonable to believe that the required soil colors could be reproduced at the present time by some artist.

REPORT OF THE COMMITTEE ON PUBLICITY AND INFORMATION

By P. E. Brown, Iowa State College.

The problem of securing the right kind of publicity and disseminating desirable information regarding the soil survey is one which confronts every state which is carrying on that work. Conditions vary so widely in the different states that the same methods of solving the problem are not applicable in all cases. Available facilities must be utilized, whatever they may happen to be and the methods followed must meet the exigencies of the local situation. Hence it is impossible to lay down any hard and fast rules regarding publicity and only more or less general suggestions can be offered.

This committee is not prepared to present any new or startling aspects of the publicity problem, and may not suggest anything which will be of any practical service. If the report serves, however, to stimulate some thought and discussion along these lines, our object will have been accomplished. Perhaps a chance word may give someone a new idea which will be of interest. Perhaps our discussion may serve merely to crystallize the ideas in some of our minds. Perhaps we shall have only an exchange of opinions and policies. But in any case, we may all benefit to a certain extent, by learning of experiences elsewhere, by viewing the problem from different angles and by considering briefly the merits of the various publicity methods which are in vogue.

THE NEED

In the first place it may be well to consider why any publicity is necessary. It is a sad but true fact that the real reason for a publicity program in most states is because of the necessity of securing appropriations for the work. Only one state with which we have had correspondence reported that no publicity was needed because no special appropriations were secured. Most of us have to consider constantly how to secure public approval of our work so that our State legislatures may generously permit us to continue our efforts to be of service to the Agriculture of the State.

But after all, I am inclined to believe that the necessity for publicity, whatever its source, is not an unmitigated evil by any means. In fact in our efforts to secure support for our work we are obliged to popularize it. This is manifestly desirable. It is necessary to explain it, to show how the maps may be of service and to use every effort to bring the results to the attention and use of the farmers. When we do this, we "kill two birds with one stone" as it were, for we secure the favorable attention of the public which militates in our favor with the state legislatures and we also accomplish the chief object of the soil survey--the betterment of crop production through a knowledge of soils and their needs.

We may conclude, therefore, that proper publicity is really very desirable in all soil survey work even if not "financially" necessary in order that the purpose of the work as ultimately contemplated, may be more quickly and more generally accomplished.

There need be no less scientific value to the results secured because of the popular presentation of such parts of the work as will bear popularization. Soil Science, in the long run, will gain rather than lose by practical tests of the fundamental facts which are constantly being uncovered in the soil survey. The portion of the work which may be used popularly must, however, be chosen carefully and this presents a problem which will be mentioned later.

THE AMOUNT

Assuming then the need for publicity, the next question which arises, pertains to the amount of such publicity. One of our correspondents believes that we have reached the stage where a great whirlwind campaign of publicity would not be to the best interest of the work. This is undoubtedly true for several reasons. The most important of these is that too much publicity would be an actual detriment to the work because it would lead to greater demands upon us than we could meet. I refer not to the amount of work but rather to the practical conclusions and recommendations drawn from the work. Over-enthusiastic editors and feature story writers often actually harm their cause because they lead the public to expect too much. We must be careful in the soil survey that we make no claims that we cannot back up, otherwise we may bring discredit upon the whole project.

Our conclusions in regard to the amount of advertising may be summed up in the word "judicious"--a very much overworked, often improperly interpreted word--but one, nevertheless, which alone expresses the thought here.

THE PLAN

The plan to be followed in securing publicity and providing information should be carefully worked out. In how many of our states is there a definite plan? Our correspondence does not answer this question, but reading between the lines, it would seem that in practically all cases the plan is merely to publish something occasionally when "the spirit moves us" and to speak on the survey when the opportunity presents itself. Too often we spend much time wondering why on earth the farmers in our states are not progressive enough to know all about the survey, while we do not follow any systematic plan of telling them about it.

A definite plan for publicity will solve many of our difficulties, and we believe that it is almost as important to have a well planned out program for publicity and information as it is to have the very complete and comprehensive outlines for the actual soil survey work, which are required of all of us. Haphazard, chance publicity will not bring results any more than "hit or miss," reconnaissance mapping will give us accurate maps.

Just what plan should be followed cannot be suggested as conditions will of necessity determine that. The actual plan is really of secondary consideration. The main thing that we would urge is to have a plan and to follow it as closely as possible. Every member of the staff should not feel free to send out news items as he sees fit--the policy of the department should be fixed so that some one or two men see that only proper material is submitted for publication. This does not mean that all should not aid in the publicity work but merely that it should be safeguarded from improper, often unintentionally unwarranted statements. If the plan for publicity calls for a short article each month in the college news letter, different men may prepare the material but if one man is responsible for the editing then there is absolutely no danger of having to issue apologies and corrections. From our own experience, I would say that if you keep something coming in regularly to the College News Letter, you will avoid having the Editor of that Letter take the liberty of making up a story about your work which may cause you some difficulties.

Again if your plan provides for meetings in charge of extension men, these men should be able to give full information on the survey and your plan should prescribe rather definitely just what information and statements they should give out. Too often these meetings do not aid the survey as they might because the men holding them know too little about the survey or take the opportunity to set forth views of their own rather than the teachings of the college and station. Truly for soils extension men, as Prof. Miller told you last year, we need men who have had some soil survey experience and therefore have the proper viewpoint.

These few remarks will serve to show that we would urge that a plan or project for publicity be worked out in some detail in order that the best results may be secured.

THE METHODS

The methods which may be followed in carrying out the publicity and information campaign must receive most careful consideration. The committee report last year set forth the ways and means employed in the states and we can only repeat and emphasize some of the suggestions made then:

Many are agreed that the state report on the soil survey of a county, containing not only the map, laboratory, greenhouse and field experimental results but also practical recommendations regarding soil treatment provides one of the most desirable means of publicity and information.

The use of the pamphlet prepared by the Association on "The Value of the Soil Survey" is proving of value in some states to attract interest to the work. Periodic news letters pertaining to the progress of the work in individual counties and in completed areas are recommended. Publications of articles from time to time in the College News Letters, and in the state papers is always desirable under the restrictions mentioned above. Special circulars and bulletins on the work will be very desirable in many cases.

The field experiment work on individual soil types should undoubtedly be made an integral part of the soil survey program and the results from these tests will prove of large value in publicity work.

Meetings of various kinds are suggested in different states. The Extension Workers are depended upon primarily for these meetings and these men may hold special soil survey meetings in surveyed counties with very satisfactory results. Talks before local Farm Bureaus, County Agents, Real Estate Associations, Short Courses and any general meetings of farmers should be given whenever possible.

Some work on the soil survey methods and discussions of its value and use should certainly be given to the students in our agricultural courses in the colleges and carefully selected work may also be of value in high schools and even in grade schools where agriculture is taught.

Demonstration meetings on experiment fields are of much interest and always attract favorable comment. Special demonstration fields may be laid out by the Extension men or the County Agent and in surveyed counties they will prove of especially large value.

The soil surveyor is not free from all responsibility in this publicity work for he has considerable contact with the farmers in his work and may do much to aid in creating a favorable impression regarding the work. One state provides the men with cards setting forth the purpose, plan and value of the soil survey and these cards are distributed to farmers. The surveyor, however, should always feel the necessity of talking with interested farmers and giving them information regarding the work even if it interferes to some extent with their work. Too much time spent with farmers will, of course, delay the mapping and the field men must exercise judgment in this matter.

It is apparent that a wide variety of methods may be employed in publicity work and the selection of methods must be based upon several factors such as the local demands, facilities available, personnel, funds which may be utilized, and material which is suitable for use. It is particularly important that close attention be given to whatever methods are followed in order to observe their efficiency. Changes or modifications may be needed constantly in order to secure the best results.

THE MATERIAL

Finally we may mention briefly the material which may be utilized in publicity work. General informational statements on the purpose, nature and value of the survey are of special value in areas to be surveyed or in states just taking up the work. Popular reports on the progress of the work in areas being surveyed are timely and very desirable. Circulars or bulletins by the Station carry worth while information to the general public and may prove valuable. The material employed in all these statements or publications is necessarily of a very general nature and popular in character.

The state reports should also be popular in nature and should include besides the map and thorough descriptions of all soil types and their needs, the results of chemical or other laboratory analyses and the data secured in greenhouse and field experiments. They will then prove of the most interest to the farmers and agricultural public in general. Further the reports and maps will provide the essential material for soil survey meetings held in surveyed counties. Other material may of course be used in these meetings as it happens to be available but the maps and reports are absolutely necessary.

The experiment fields provide abundance of material for field meetings and demonstrations and the results secured from them are of use for all other soil meetings, for general lectures, for news items, feature articles and special reports.

Exhibits at fairs and at shows of different kinds demand a special sort of material and much ingenuity is necessary to prepare and put on an exhibit. There is much that may be used from the soil survey but our experience is that the soil map and the field experiment results are the most popular and they never seem to lose their interest.

In general it may be said that any of the results of the soil survey work which are capable of popular presentation may serve for publicity material. Again, however, it should be emphasized that the use of the material should be "judicious" and according to a well-defined plan.

In conclusion, we would merely repeat that good publicity for the soil survey is not only of value in the securing of appropriations but is really fundamental to the accomplishing of the real purposes of the work.

Our problem then is to outline a definite publicity campaign, select the methods carefully, choose the most suitable material, and see that the amount of publicity is judicious. Only in this way can the desired results be secured.

Committee on Information and Publicity,

P. E. Brown

C. P. Shaw

W. E. Hearn

REPORT OF THE COMMITTEE ON IMPROVEMENT OF SOIL MAPS AND REPORTS

By, W. J. Geib, Wisconsin Cooperative Soil Survey.

The Steering Committee which was appointed at the last annual meeting of the Association recommended that the Chairman of this committee be authorized by the Bureau to spend some time in a well known lithographic plant for the purpose of becoming thoroughly familiar with the making of maps and to learn as much as possible about map construction from the inside so that this information could be of use to the Association and its members in the improvement of soil maps. Inasmuch as the Bureau did not authorize the Chairman to make this special study we have nothing to report on that particular phase of the work.

As a member of the Committee, Professor Krusekopf is to give an address at this meeting on the improvement of soil reports, we shall not take time to go into that phase of the question in this report. The Committee, as such, has held no meetings and we have had but little correspondence.

The improvements in soil maps to which I wish to direct your attention at this time, are those which are being attempted by the co-operative Soil Survey in Wisconsin. At the last annual meeting we exhibited before the Association a proof copy of the revised map of Outagamie County, Wisconsin. This map has finally been printed and a State edition of the report together with this map will soon be ready for distribution. A copy of this map is placed on exhibition for your inspection. It will be noted that the improved Legend which the map has is on the side instead of at the bottom. This became necessary on account of certain lithographic difficulties and not because of our desire to have the Legend on the side.

Our Jackson County map has been modified along the same lines and we are placing before you a copy of the map of Jackson County, Wisconsin which you will note has this revised legend at the bottom of the map in the space which was previously blank. On the Jackson map the new legend has required no extra space and the additional cost for 3,500 copies was only \$75.

Our purpose or the main object in revising the legend is to make the soil map tell a complete story by itself and also to prepare it in such a way that it will be suitable as a wall map, which will permit it to be used in schools, banks and numerous other places.

It will be noted by inspecting this map that the various soil types have been arranged in textural groups and that the revised legend has been divided into five separate parts. The first part gives the "Name of the Soil", such as Superior clay loam. The second part gives a "description of the Soil and Subsoil" and for this particular type reads "Brown clay loam on heavy compact red clay." The third division gives the "Surface features and drainage," and for this type we quote the information that the soil is "level to undulating, surface drainage fair, under drainage slow." The fourth division gives "Uses and adaptation" of the soil and for this type we have the following, "Small grain, clover and timothy, grazing silage,

peas and sugar beets. Good dairy and general farming land." In the fifth division we have "Fertility and methods of improvement." Under this heading we find "Seldom acid, somewhat deficient in organic matter and phosphorus. Green manuring important. Acid, phosphate or mixed fertilizer may be used to supplement the stable manure. Good rotation consists of clover and timothy, corn for silage, and small grain. Tile drains are profitable on most of the level land."

By having the soils in textural groups it will be seen that some of these descriptions in the various divisions will apply to more than one type. By this group arrangement we can thus save considerable repetition.

Work is now being carried forward on the revision of the soil map of Kenosha and Racine Counties and it is proposed to have a legend of this kind for that map also. One additional feature which is being introduced is in the first division of the legend. We are suggesting that the acreage of each soil be given under the color block so that by inspecting the legend one can readily determine the importance and actual extent of each type of soil.

We might call attention to another change which is being made in the map of Racine and Kenosha Counties of Wisconsin. In this area which covers two counties the work in the field outlined for example, Clyde soils, Maumee soils and Newton soils, all of which are retained on the Bureau's map. The soils are black, poorly drained lands and in the heavier members of the series the soil sections extend to a depth of over three feet before a lighter material is found. In order that the map may be simplified it is proposed now that these three series, when the type will permit, all be correlated as Clyde soils. They appear to have practically the same agricultural value, and all require drainage before they can be farmed successfully. The degree of drainage needed is practically the same in all cases, or at least the variation between series is no greater than the variation in the series. By making this correlation the number of types is reduced somewhat and the map is simplified. It also does away with the introducing new type names for soils which were previously mapped under old established type names.

I trust that those who are interested in the improvement of maps will carefully inspect the exhibition here shown and make constructive criticisms and suggestions. We feel that some improvement has been made in the legend but there are doubtless many other respects in which the legend and maps may be changed to advantage.

Committee on Improvement in Soil Maps and Reports.

W. J. Geib

H. H. Krusekopf

J. O. Veatch.

THE IMPROVEMENT OF SOIL SURVEY REPORTS.

By J. O. Veatch¹.

1. Member of the Committee on the Improvement of Soil Survey Reports.

The Soil Survey report, as an ideal scientific publication, should be concerned primarily with soil classification and the description of soils per se. However, at present for a number of reasons, it is expedient to include a measure of agronomy and other extraneous matter bearing upon agriculture.

The following arrangement and order of the subject matter of the report is suggested, each subject to form a center heading.

1. Geography of the Area
2. Soils
3. Description of Soil Types
4. Agriculture
5. Climate

It is believed that side headings would simplify and make the report more readable for all classes of readers. Under Geography of the Area, the following suggestions are offered.

Location and Area.--Restricted to a statement of the position of the area within the State and to its size in square miles and acres. Mention of latitude and details of boundaries, shape and dimensions are relatively trivial.

Topography.--A brief, concise description presenting the information of most significance in relation to soil classification and agriculture; a presentation of the topographic aspect by employing the descriptive terms in common use such as level, rolling, mountainous, etc; elevation above sea-level and local differences in elevation; drainage--as determined by gradient of slopes and perviousness or imperviousness of substrata. The names and descriptions of the courses of streams in the area are obvious from an inspection of the soil map and add nothing of value in text of the report. A sketch map showing the topographic divisions in those areas which possess contrasts in topography and well marked divisions, would be a valuable addition to the soil survey report.

Native Vegetation.--A mention of the original plant formations and associations would have a purely scientific value in soil studies and would have a practical bearing on agricultural development in those areas containing large amounts of virgin land.

Water Supply.--From the purely agricultural point of view, a paragraph on the source and quality of the water supply for domestic and general farm purposes is recommended.

Industry and Natural Resources.--Brief mention of industries and principal natural resources--confined to one or two paragraphs. Details of the nationality of the early settlers and the present population; towns and their population; highways; railroads; and telephones is information usually sent out by chambers of commerce and other advertising agencies and might be omitted without affecting the value of the report. Possibly the mental energy of the writer could be employed to greater advantage on parts of the report of a more technical nature.

In the chapter on Soils the following treatment is suggested.

1. Introductory paragraph in which the outstanding soil characteristics of the area as a whole are mentioned.
2. A brief description of the generalized profile of the soil developed: (1) under conditions of good drainage; (2) under conditions of poor drainage. The lithologic nature of soils which are equivalent to geologic formations as recent alluvium, beach deposits, etc.
3. Basis of classification of soils for purposes of mapping. The distinguishing intrinsic characteristics of each subgroup or series, without reference to its geologic or topographic relations.
4. Evaluation of geology, topography, native vegetation and age as modifying and determining factors. Basically the soil is a function of conditions of moisture and temperature which have obtained over great periods of time.

It is believed that the newer conception of soil classification should be adopted. In this, the grouping of soils is based upon the recognition of the complete soil profile, without limitation as to thickness, and the peculiarities and arrangement of its separate parts or horizons. Mappable units are established on the basis of intrinsic peculiarities, both physical and chemical, independently of topography and geology.

Description of Soil Types.

In the technical description of the soil type, clearness and conciseness are more important than in any other part of the report. A description of each horizon or separate part of the complete profile beginning at the surface and listing each by number or name, would greatly aid the reader in visualizing the soil.

It is recommended that color and other differences between the virgin soil and the cultivated soil be brought out; likewise the differences traceable to different amounts of moisture in the soil.

Laboratory data, both chemical analyses and physical determinations, when available should be included, but should be frankly interpreted.

A mention of the range in physical and chemical character allowed in mapping and a detailed mention of the location and occurrence of inclusions

of other types, should be incorporated in the description of the soil type. The soil map leaves the impression, that the area covered by some one color or pattern is uniform in soil--which may not be true because of the scale of mapping employed or due to an attempt to draw too fine textural distinctions.

Statements of the selling price of land have only a transient value at best and might be omitted.

Agriculture.

The chapter on agriculture should be greatly abbreviated, since from the title, the report is ostensibly a soil survey--not a survey of agricultural conditions--and should therefore be restricted as far as practicable to the description of soils and the science of pedology. Greater attention given to bringing out the relations of the distribution and yields of crops and farm methods to soil types would be a distinctive improvement.

Climate.

It is believed that a fuller interpretation in relation to agriculture of the climatic data presented would make the report have a higher value. Additional weather bureau data upon frequency and duration of droughts; evaporation; percentage of clear days or amount of sunshine; frequency of hail storms, depth and duration of the snow cover would add to the value of the report from the agronomic point of view.

Summary.

The summary as at present written does not enhance the literary value of the report, and because of the nature and brevity of the average report, it is questionable whether a summary is needed at all.

REPORT OF THE COMMITTEE ON CORRELATIVE LABORATORY WORK.

By G. W. Conrey, Chairman.

As a basis for making suggestions for the development and expansion of laboratory work as a part of the Soil Survey, exact information concerning the nature of laboratory work under way is desirable. To this end inquiry has been made of the various organizations engaged in Soil Survey work. In order to systematize the information answers were requested to the following questions:

1. What laboratory work is being done in connection with the Soil Survey in your State? List determinations being made, either chemical, physical or physico-chemical. If "availability" or solubility determinations are being made in connection with chemical analysis of soils, indicate the elements so determined, and the general method employed, as N/5 HNO₃ digestion, etc.. Distinguish between laboratory work connected with the Soil Survey and distinctly research projects of the Station.

2. What additional determinations of either a chemical, physical, or physico-chemical nature might be made to advantage in connection with Soil Survey Work.

These questions have been addressed to forty states or organizations, including the Bureau of Soils and four Canadian Provinces. Laboratory work has been reported by twenty-eight of this number. The following report is very largely a summary of the data secured from these replies.

A. Laboratory work being carried on by the various States engaged in the Soil Survey.

Number of States reporting laboratory work--28.

1. Chemical.

a. Complete analysis	1	(Bureau of Soils) (3)	
b. Total analysis		c. Solubility determinations.	
Phosphorus	21	N/5 HNO ₃	4
Potassium	17	Phosphorus	4
Nitrogen	23	Potassium	4
Calcium	13	Calcium	1
Magnesium	10	Strong HCl	1
Sulphur	6	Water soluble salts	6
Inorganic carbon	9	Water CO ₂	1
Organic carbon	12		
d. Lime requirement or reaction	17		

Methods. Veitch
Hopkins
Truog

Jones
Delaware (Sodium acetate)
pH

2. Physical analysis.

Mechanical analysis	12
Moisture equivalent	6

3. Physico-chemical determinations.

Dilatometer determinations	1
Heat of wetting	1
Colloidal content	1
pH value	2

It is evident from this summary of the work now being carried on that total chemical analysis makes up a large part of the laboratory work, "Availability" or solubility methods are being used to a very limited extent at present, although as will be shown later the interest in such methods is very great.

Of the various physical determinations, mechanical analysis, along with the moisture equivalent determination are the only ones of importance.

Of the physico-chemical determinations, use has not as yet become very general.

It is recognized that many of these methods are being used rather extensively in research projects, but as yet have not been taken up in the Soil Survey laboratory.

B. Additional determinations which would be of value, suggested in answer to the second question.

1. Complete chemical analysis of selected soils.

The value of complete chemical analysis in the study of soil development is of much importance, especially when soils are studied as such, rather than from the geological point of view. In fact chemical analysis must take the place of many of our generalizations based on the source and mode of origin of the soil. However the expense involved will limit the amount of this type of laboratory work.

The information secured from the analysis of extremely carefully selected samples undoubtedly will prove to be very valuable. The desirability of uniformity of methods, both in securing samples, also in making the analyses should be emphasized.

2. Mineralogical analysis of selected soils. The question as to the value of mineralogical analyses has been raised. As an aid in interpretation of complete chemical analyses it is of great value and is of use in the same field, that is in studying soil development. Up to a recent date

mineralogical analysis has been limited to determinations on the sand and silt separates, but it is very gratifying to learn that new methods have been devised whereby satisfactory determinations can be made on particles down to .001 mm in diameter. This opens up an entirely new field to the soil mineralogist.

3. "Availability" or solubility determinations. It is probably true that the desire for such methods is universal, but unfortunately thoroughly satisfactory methods are yet to be devised. The value of the present methods may be questionable, however, the results are interesting, and may in some cases be of as much value as a total determination.

4. Condition of combination of calcium in soils, whether as carbonate, hydrated silicate or silicate. Solubility methods combined with mineralogical analyses should throw some light on this problem.

5. Determination of colloidal clay, also colloidal organic matter. The need of further knowledge concerning the physical properties of the clay separate has been expressed. Methods for determining the colloidal content of soils have been largely indirect and in general unsatisfactory. A new method to be reported shortly has been devised by the Utah Station, work on soil colloids is also in progress at the Bureau of Soils and the Missouri Station. If a satisfactory method for estimation can be devised it will be of great value in the study of heavy soils.

6. Dilatometer measurements.

7. Heat of wetting.

8. Solubility measurements by the freezing point method.

These methods which have been devised by Professor McCool and his co-workers have proven to be of considerable value.

9. Moisture equivalent of soils.

This determination is being made by a number of Stations, and is looked upon with considerable favor. It gives a means of expressing or measuring the water requirement of soils. Considerable work has been done in studying the factors which effect the result of the determination on a given soil.

10. Permeability of soils. Additional studies are needed as to the physical nature of soils, especially as regards the heavy subsoil layer which has developed in many of our soils, and limits the rate of movement of water.

Standardization of methods. Undoubtedly every organization engaged in laboratory work has spent some time on methods, but in many cases results have not been published. The opportunity for cooperation between the various organizations in perfecting methods, and in the dissemination of information concerning methods of value is very great. Several of the Stations have indicated that Official Methods are used. A study of the methods used as

published in the soil survey reports reveals considerable variance, in some cases sufficient to effect the results obtained. An opportunity for constructive work is offered in the correlation of laboratory methods.

Committee on Correlative Laboratory Work.

G. W. Conrey

M. M. McCool

R. S. Smith

REPORT OF THE COMMITTEE ON THE FUTURE FIELD OF
THE SOIL SURVEY WORKERS ASSOCIATION.

By M. F. Miller, Missouri.

The instructions of this association to the committee appointed to make recommendations regarding the future field of this organization were to consider three propositions; first, continuing the organization in its present form; second, enlarging the field of the association to include the whole subject matter of soils; and third, combining with the American Society of Agronomy or other organization. In the event that the committee recommended an expansion of the field of work it was also to suggest a suitable name for the organization.

As to the future scope and allocation of the work of this association, the committee has found it difficult to reach a satisfactory conclusion. It does not believe it wise, at this time, to recommend the formation of an association dealing with the whole subject matter of soil science, since this would doubtless be considered as infringing on the rights of the American Society of Agronomy and since such a plan should have the general sanction of the soils men of the country, rather than those concerned primarily with soil survey work.

There is a general feeling among the members of the committee that one strong organization representing the general subject of agronomy, with distinct sections for soils and crops, is preferable to two or more organizations dealing with different phases of the agronomic field. Should the soils men withdraw and form a new organization there would be danger that neither the old nor the new organization would survive. On the other hand, the soils work of the country is already represented by a rather strong periodical in "Soil Science" and it is possible that an organization of soils men might be able to use this as an official organ and by a narrowing of interests form an association with greater vitality than the general agronomic organization. This, however, seems rather doubtful, and the committee is not ready to recommend such a radical departure at this time.

With reference to making this association a part of the American Society of Agronomy there are some real difficulties. There is no doubt that a simple fusing of the two organizations would result in the obliteration of this one. Moreover, the setting apart of a certain session of the Agronomy Society program for the consideration of soil survey problems would not serve to bring together a representative number of soil survey workers.

The only plan that seems at all feasible in the matter of an organic union with the Society of Agronomy is to ask that association to establish a soils section, or possibly a field soils section to which one or two days programs should be devoted at each meeting. It seems doubtful if the Society of Agronomy would look with favor on a field soils section, while if a general soils section were established the tendency would probably be to consider subjects having to do with soil treatment and management rather than those dealing with field soils.

Another disadvantage to meeting with the Society of Agronomy is that these meetings are usually held in connection with those of the Land Grant Colleges, at points which are often very inconveniently reached by a large body of soil survey men. This would doubtless result in a poor attendance of active soil survey workers, and thus greatly lessen the value of the meetings.

Another plan which has been suggested is that of affiliating with the Society of Agronomy but as a distinct organization. In this case the association might meet with the Society of Agronomy on those years when the meeting place was desirably located, and possibly on other years it could hold separate meetings, in a more central location, yet in direct affiliation with that society.

The committee must admit frankly that it has not been able to reach a satisfactory conclusion regarding these matters. It believes that the subject will require the joint consideration of representatives of this organization, of other interested soils men and of representatives of the American Society of Agronomy, in order that a sane and satisfactory conclusion may be reached. Moreover, the committee feels that we have by no means exhausted the subjects of immediate importance in soil survey work and that we can advantageously hold at least one more meeting under the present plan.

The committee, therefore, RECOMMENDS that the present organization be continued without change of name, or of field, and without special affiliation with other organizations for at least another year, during which time the matter may be carefully considered by representatives of this association, representatives from the American Society of Agronomy and others who are interested.

Respectfully submitted,

C. F. Marbut
R. Harcourt
F. J. Alway
P. E. Brown
M. F. Miller, Chairman.

Committee.

REPORT OF THE COMMITTEE ON THE CLASSIFICATION OF ORGANIC SOILS.

By F. J. Alway, University of Minnesota.

The committee recommends as a report of progress:

- A). That the committee be continued.
- B). That the profile of organic soils be given careful study.
- C). That the Chief of the Bureau of Soils of the Department of Agriculture be requested to assign one of the most experienced field men of the Bureau, and preferably one who is well acquainted with the organic soils of the Gulf states, to visit before the next meeting of the Association at least the Gulf states, California, Idaho, Minnesota, Wisconsin, Iowa, Illinois, Indiana, Ohio, Michigan, New York and Massachusetts, to study the profile of these soils and collect representative samples, working in cooperation with the respective Agricultural Experiment Stations wherever these are able to assist, and on the basis of these studies to recommend for the consideration of the committee a scheme of classification.
- D). That in describing these soils at least the following properties be recognized:

- 1) Content of mineral matter.
 - 2) Degree of decomposition, or comminution, of the plant residues in the virgin soils.
 - 3) Thickness or depth of the organic layer.
 - 4) Character of mineral substratum, where the peat is not too deep for this to be conveniently determined.
 - 5) Color.
 - 6) Adequacy of the lime supply and saline or "alkali" character.
- The character of the native vegetation, while not being recognized in the classification, should be recorded by the field men wherever it has not been destroyed or seriously modified.

Notes on Suggestions in D.

- 1) Content of mineral matter.
 - a) Conclusions of the field man as to the relative content of mineral matter should be confirmed or corrected by ash determinations of a sufficient number of representative samples.
 - b) Three subdivisions are suggested, preferably retaining the terms peat and muck for the two highest in organic matter.
 - c) Vegetable or leaf mold should be distinguished from peat and muck.
- 2) Degree of comminution or decomposition.
 - a) Virgin soils should be considered in dealing with this property, but where adjacent soil has been under cultivation for some years the degree of comminution of the surface of this should be reported.

- b) Three subdivisions are suggested--fine, granular and coarse (or fibrous).
- 3) Thickness or depth.
 - a) Three divisions are suggested, namely:
 - 1) Deep--more than 3 feet or beyond the reach of the ordinary soil auger.
 - 2) Shallow--from 12 to 36 inches in thickness.
 - 3) Very shallow--less than 12 inches deep and hence liable to have the mineral substratum brought to the surface in the course of tillage operations.
- 4) Character of the mineral substratum.

In general the recognition of this is feasible only with shallow peats and for these five subdivisions are suggested, namely those where the substratum consists of, a) Sand or gravel. b) Clayey or silty material. c) Marl. d) Stones and boulders. e) Rock (country rock).
- 5) Color.
 - a) The color of the virgin soil should be dealt with, but, if any of the soil has been under cultivation for some years it is desirable to also report upon the color of this.
 - b) Color standards should be established from the collection which the Bureau of Soils is requested to make.
- 6) Chemical composition.
 - a) The adequacy of the lime supply for ordinary farm crops should be recognized in the classification insofar as such adequacy has been established by farm practice or can be decided upon from the chemical analysis of representative samples. The ordinary simple tests for acidity are recognized as not dependable in the case of these soils.
 - b) Where the content of soluble salts is sufficient to be injurious to crops this should be recognized by such terms as "saline" and "alkali."

COMMITTEE ON CLASSIFICATION OF ORGANIC SOILS.

F. J. Alway
A. R. Whitson
M. M. McCool
S. D. Conner
R. S. Smith
C. F. Shaw
H. H. Bennett.

SOME SUGGESTIONS REGARDING SOIL SURVEY REPORTS AND THE SOIL SURVEY.

By Macy H. Lapham, Inspector, Western Division
Bureau of Soils.

Analysis of some of the earlier, later and present day soil survey reports presents some interesting comparisons indicative of the development in the science of soil surveying and in the art of presenting the data accumulated in the field, from which it is believed some pertinent suggestions may be gleaned.

The first of these, written during the experimental and early formative stages of the soil survey were without precedent or prescribed uniform method of treatment, or were suggested in scope, style or form by few previous publications of such character. Nevertheless they mark what will some day be recognized as one of the milestones in the development of American agricultural research, though in the light of present day standards of conciseness, definiteness and uniformity they leave much to be desired.

In the discussion of physiography and geology which in the earlier reports is accorded the place of a distinct chapter, there is a tendency to dwell too much upon problems of regional physiographic development and geologic history, and to give too meager discussion of such features in relation to soil formation, soil differentiation and soil utilization,-- a questionable practice from which we are not yet entirely divorced.

Discussion of Agriculture in the earlier reports is reserved for the last under head of a general chapter on Agricultural Methods. In the western surveys additional chapters on Water Supply for Irrigation, Underground and Seepage Waters, Alkali in Soils, and Alkali Land Reclamation are frequently included, in which some of us have plunged into discussion of highly technical problems in considerable detail. In some cases predictions were freely made as to future status with regard to alkali problems, based upon incomplete or unreliable data, and which have resulted later in harmful criticism. It might be said in passing that it now appears that the specialists in the physics and chemistry of alkali soils and alkali land reclamation, have by their own confession found so many things yet to be learned that there is a tendency in present day soil survey reports to discourage attempts to discuss the problem with finality, or to enter far into predictions for the future, and to confine treatment of this subject to a simple statement of facts as regards amount and distribution of alkali accumulation as indicated by field tests and visual evidences.

In the earlier of the reports there is no general chapter on Soils, or discussion under this head is incomplete and inadequate; and under description of soil types dominant soil characteristics of color, structure, development or occurrence of distinctive subsoils, substrata or horizons, etc.; now recognized of so much importance in soil classification, are

entirely or almost wholly overlooked. Any attempt to correlate soils encountered in the later surveys with those of these earlier areas on the basis of their description alone is futile.

The sequence of soil type descriptions was frequently arranged in a haphazard manner, usually in the order of their extent or agricultural importance, and without regard to order in which previous mention of the soils may have been made or to relation of the soils to the series classification or to each other. This rendered it difficult for the layman to acquire a clear conception of, or to hold in mind the soil series relationships.

The soil type descriptions were, and still are in most instances, preceded by a table enumerating the various soil types in order of their extent. (See Anaheim Area, Cal. Field Operations, 1916). Should not this table rather be so arranged that the soils will be consecutively indicated in their natural relationship with regard to province or major groups, than to series and types, as for instance in the report upon the Reconnaissance Soil Survey of the San Francisco Bay region, (Field Operations, 1914). In this report this table is arranged first with regard to the mode of accumulation or derivation of the material, enumerating (1) the soils derived from residual materials, (2) the soils derived from coastal plain and old valley filling materials, (3) the soils derived from recent alluvial materials; and (4) the soils derived from wind laid materials.

Under each of these major or province groups as the "soil province" is recognized in the western states, are indicated in uniform order the distinctive color differences as for instance, red soils, reddish brown soils, brown soils, yellow soils, and black soils. Each of these sub-heads is followed by the series names properly included, the Aiken series and the Sites series representing the red soils, the Holland series and the Olympic series representing the brown soils, etc., each of which is followed by enumeration of the individual types in order of textural progression from the coarser to the finer materials. (Exhibit table enumerating soils of the Anaheim Area rearranged according to tabular arrangement suggested). In other words this table can be made to serve a two-fold purpose if arranged in the same sequence in which the series and types are logically discussed in the report, explanatory not only of the relative extent of the various types, but of their mutual relationship and of the principles of their differentiation. Might we not consistently go a step further in this and introduce in the map legend the tabular arrangement suggested above with such modifications as might be prompted by local conditions?

With the later development of the principles of soil classification and differentiation, and improvement in field technique, has come a more complete and precise description of the soil type as formulated in the official approved outline for soil survey reports. Even with this as a guide, however, soil type descriptions are frequently too brief and woefully inadequate, and characteristics of color, texture, structure, depth or

thickness of the surface soil or underlying horizons or strata, or other important features are often slurred over or overlooked.

In the soil series descriptions not only should these be complete in every detail with respect to the typical material of an established series as recognized in previous surveys, but greater attention should be given to describing and explaining variations or inclusions which may occur in the area under discussion, which are recognized as departing from the typical but which are included for reasons which should be clearly stated. In some cases in which this is overlooked a description of the typical series material is given, followed later by description of individual types under this series recognized in the individual area as representing local variations or inclusions, and which conflict in color, profile or some other important characteristic with the series description previously given. Such instances lead to confusion in the mind of the layman who attempts to utilize the soil survey reports and gives opportunity for criticism of our service and our work.

It is further suggested that more frequent practice be made of stating in a few words the salient distinctions by which each series is differentiated from the soils of the related or associated series occurring in the area.

There is also in the mind of the writer, grave doubt as to whether the soil series descriptions should not better be removed from the general chapter on soils and given in connection with the soil type descriptions, the description of each series to be followed in order with discussion of its individual members or types. Such manner of treatment is logical and aids the mind in grasping and assimilating the principles of soil differentiation and series relationships. This appears to be desirable particularly in areas in which a large number of soil series and types are concerned as in some of the western reconnaissance surveys in which this practice has been followed. (See Reconnaissance Soil Survey of the San Francisco Bay Region, Cal. Field Operations 1914; Reconnaissance Soil Survey of the Central Southern Area, Cal. 1917). Objections have been offered in case of reports upon the Eastern and Middle States, however, that were this to be followed there would be little or nothing left for the general chapter on soils. We are now finding so many new and interesting things in connection with soil accumulation and soil development, and the relation of the various series to each other, that in the western areas at least where soils derived from a variety of sources, accumulated by various agencies, and exhibiting widely different characteristics, often occur within a single small valley or area, this objection now seems hardly tenable. Furthermore explanation or definition of the units of classification and of the nomenclature of the soil survey properly falls under this chapter.

There is in every soil survey report a question as to how much space, if any, should be devoted to definition and explanation of what is meant by the soil province or the soil region, the soil series, the soil type,

the soil phase or other technical terms and units of which use is made, or in calling to the attention of the reader inherent limitations which occur in the field classification of soils and their delineation upon the soil map. In the western reports the inspector has in most cases written and inserted definition or interpretation of such terms which are seldom explained by the author of the report. Such material is admittedly of little use to the soil technician or to one familiar with the principles of soil surveying and accustomed to the use of soil survey reports, in which case it occupies needless space and adds to the cost of publication. We must, however, bear in mind that a large proportion of the soil survey maps and reports are utilized by farmers, bankers, real estate operators, engineers and men of various professions who are not familiar with our system of soil classification or the terms in use. Brief treatment of what may be termed "basic definitions" explanatory of the terms and units of classification and mapping would, therefore, seem necessary that the soil survey reports might be clearly understood and fully utilized. Even in the official bulletins or other publications of the cooperating State Experiment Stations in which attempt is made to adopt the nomenclature of the soil survey there is frequent evident misunderstanding and misuse of soil terms, particularly those pertaining to the soil series and the soil type.

This problem is not peculiar to the soil survey. Much the same condition exists with regard to the Geologic Folios published by the U. S. Geological Survey. In these, explanation of the purpose, utilization and limitations of the topographic and geologic maps and of the terms and units of geological classification, is concisely given and printed in small type on the inside covers of the Folio. The trained geologist does not need to bother with these but may turn at once to the body of the report. To the layman they are essential in understanding and utilizing the text.

Might it not be possible to have prepared full but complete and carefully worded definitions and explanations of similar technical units and terms encountered in soil survey literature, to be uniformly printed in small type on the inside cover of the soil survey report or if this be impracticable to be inserted in the chapter on soils or as an appendix to which the casual reader may be referred? Such definitions or concise descriptive material might be drawn up by the Bureau of Soils or by a Committee to be appointed from within the body of this Association. It could be printed or mimeographed and inserted in its proper place in the manuscript by the Editorial Division, thus saving the time of the author or the inspector who would otherwise be responsible for its preparation. Should this procedure not be deemed feasible, then explanation of such units and terms necessary in fully understanding and utilizing the reports should by all means be provided for in our outline under the general chapter on soils.

Criticism is sometimes made of the present day reports following uniformly the prescribed outline from the standpoint that both writing and reading the manuscript is monotonous and that little opportunity is left for individuality of the writer. Would not a greater latitude allowed the author

result in a more readable paper? The answer is that the purpose of the soil survey report is to tell the story of the soil survey, simply, concisely and completely, and that the soil survey data which is accumulated in various localities by various field men should be presented in a systematic, uniform manner. By such method of treatment not only are results in individual cases better attained, but comparison of data from different localities is greatly simplified and its correlation facilitated.

Another suggestion which is ventured is that the soil maps, particularly those covering large areas, be not bound in the text but published separately, folded and inserted loose in an envelope or folder. For a precedent we have but to refer to various publications of the U. S. Geological Survey. (See Water Supply Paper 490-A, Routes to Desert Watering places in the Salton Sea Region, Cal.). In at least one of our soil survey reports a similar expedient by means of which both the report and folded maps are inserted loose in a neat folder has been tried and found commendable. (See Reconnaissance Soil Survey of the Western Puget Sound Basin, Wash. 1910). (See Fresno Area, Cal.: Reconnaissance survey, Central Southern Area, Cal.; Reconnaissance survey, Sacramento Valley, Cal.).

Another criticism which might be made of the soil survey reports is the lack of references to Departmental, State or other publications dealing with technical subjects with which the field man comes in contact, and which he frequently touches upon in his report. Most of our work is now conducted in cooperation with State institutions under which experts and specialists are frequently investigating the very problems encountered or touched upon in a general way in the soil survey report. In many instances reports have been published upon these problems, of which the author of the report is in ignorance, or to which he fails to give credit due.

The field man would be greatly assisted by supplying him with a list of available publications of the Department bearing upon soil and farm problems with which he might come in contact, and further might not this be supplemented by forwarding him reports, bulletins or other publications from the Departmental library if there be any, having specific bearing upon the area being surveyed? Is there not someone in the Washington office who could inaugurate an "extension service" to soil surveyors?

Upon some of us have become indelibly fixed the results of years of isolation in the field, during much of which there was little or no systematic field inspection, no regular visits of the inspector with their opportunity for helpful criticism and encouragement, and during which for intervals of one or two years or more the field party seldom if ever came in contact with any person from their own or other technical departments of either the Federal Government or State. The irregular and infrequent visit of some one from the Washington office at such times assumed almost the importance of an event of a lifetime. Present systematic organization of the soil survey with regular field inspection and active cooperation with the States has done much to alleviate this condition of isolation, but to the writer, herein still lies one of the greatest opportunities of the Inspector to be of real service.

He has within his grasp the opportunity of being not only a critic and a scientist, but a humanizing agent, a source of inspiration and of kindly helpfulness, a purveyor of the news and family gossip concerning the activities and plans of the soil survey so keenly relished by him who is constantly in the field, by means of all of which he may assist in maintaining that intangible but no less highly essential asset of the soil survey which has been so evident under past trying circumstances, the morale and spirit of the field force.

CLASSIFICATION AND AREA OF SOILS.

ANAHEIM AREA, CALIF.

Soil Series and Types.	Acres	Per cent
Residual soils:		
Brown soils:		
Altamont series (Derived from sedimentary rocks)		
Altamont fine sandy loam.	5,632	1.8
Altamont loam	14,208	4.5
Altamont clay loam	12,224	3.9
Altamont clay	704	.2
Altamont clay adobe	3,008	1.0
Dark gray to black soils:		
Diablo series (Derived from sedimentary rocks)		
Diablo clay adobe	832	.3
Coastal Plain and Old Valley Filling Soils:		
Brown soils:		
Ramona series (Derived mainly from granitic rocks)		
Ramona sand	960	.3
Ramona sandy loam	5,440	1.7
Ramona fine sandy loam	15,360	4.8
Ramona gravelly loam	3,072	1.0
Ramona loam	31,120	6.7
Ramona clay loam	9,152	2.9
Antioch series (Derived mainly from sedimentary rocks)		
Antioch clay adobe	2,368	.7
Dark gray to black soils:		
Montezuma series (Derived from mixed rocks)		
Montezuma clay loam adobe	2,304	.7
Montezuma clay adobe	1,728	.5
Recent alluvial soils:		
Brown soils		
Hanford series (Derived mainly from granitic rocks)		
Hanford sand	12,554	4.0
Hanford sandy loam	29,056	9.2
Hanford fine sandy loam	47,360	14.9
Hanford loam	10,816	3.4
Yolo series (Derived mainly from sedimentary rocks)		
Yolo fine sandy loam	5,888	1.9
Yolo loam	27,456	8.6
Yolo clay loam	14,720	4.6
Yolo clay adobe	2,560	.8

Soil Types and Series	Acres	Per cent
Recent alluvial soils, cont'd.:		
Dark gray to black soils:		
Dublin series (Derived mainly from sedimentary rocks).		
Dublin clay adobe .	1,664	.5
Chino series (Derived mainly from granitic rocks)		
Chino silt loam	4,480	1.4
Chino silty clay loam	5,056	1.6
Chino clay loam	6,080	1.9
Chino silty clay	13,248	4.1
Miscellaneous materials:		
Muck and Peat	1,024	.3
Tidal marsh	5,312	1.7
Coastal beach and dunesand	1,344	.4
Riverwash	2,432	.8
Rough broken and stony land	28,288	8.9

SOIL SURVEY REPORTS.

By H. H. Krusekopf, University of Missouri.

The effective presentation to the general reader of the results of investigation is a matter which workers in the field of agriculture have had to consider and to deal with for many years. Soil reports are the means by which are recorded the findings of soil survey investigations. During the past ten years great progress has been made in refining soil mapping and in making it a really scientific work. Soil reports have not changed much in content and form, and have not kept pace with the advance in soil mapping. I have no desire to minimize the great value of the soil report in its present form, yet it is evident that our increasing fund of soil knowledge, as revealed by the soil survey does not find adequate expression in the soil report. The need of a change in the reports has been felt for a long time. The subject has been discussed at the two previous meetings of this Association, and some valuable suggestions have been made. However, since no definite action has as yet been taken to modify soil reports, a further discussion of the subject seems still in order.

Because of the wide range of uses of these reports and the many classes of people to which they must appeal, there are many opinions as to what a soil report should and should not contain. The question at once arises-- should the soil survey report be a technical or popular paper? Since soil surveying is a scientific study of soils, it seems logical that the soil report should be a technical paper. To prepare it in this form is the ideal report. However, practical considerations at once made such a plan impractical. The readers to whom such reports would appeal are entirely too limited to justify their publication. Moreover, the difficulty of getting appropriations for such work must be considered. Again not all soil workers have the soil knowledge to prepare a really technical paper. Soil reports must, therefore, be popular papers, written in such a way as to be easily read and understood by the layman or man of ordinary education.

In the preparation of soil reports, there are three general classes of readers that are to be considered:

1. The farmer
2. Student and investigator
3. Banker, realtor, investor and general public

It seems right that the report should be written primarily for the farmers, but not wholly so. The survey stands for a broader relation than the local agriculture. It is a contribution to the knowledge of soils. The report should be instructive as well as informing, it should be scientific in its purport and interpretation, and not alone a record of observations and facts whose relationship are not traced and whose real significance is not indicated. All information obtained on the soils of the surveyed area needs to be recorded for the benefit of advancement in soil science, even when such information has no apparent practical value.

Hence the soil surveyor cannot afford to restrict his audience to farmers, or leave out of his thinking the man in the laboratory and in the office.

The criticism has been made that soil reports employ too many terms that are not generally known or understood by the layman. I cannot agree to this. To popularize the soil report should not be construed as writing down to the public. The fault is more largely with the reader because of his limited soil vocabulary. Every field man has realized the very limited number of soil terms used by farmers and the general public. I dare say that the majority of people do not have more than a half dozen soil terms at their command, and these are confined to such general terms as sand, clay, loam. Although silt loams are the dominant soils of the United States, yet the word silt is rarely used by the layman (many people are credited with having "sand" but few there are that have silt--in their vocabulary). There seems only one solution of this problem, and that is to educate the readers to the use of the more common soil terms.

In this connection it can be said that our whole soil language is as yet too limited even among soil workers. Our soil terminology does not always enable an exact definition or description of soils as brought about by increased soil knowledge. The inadequacy of soil language particularly as it pertains to soil structure is apparent. Not only are the terms few, but those now in use are given a variety of meanings. I doubt if there are any two soil surveyors who have the same concept of the words tight, compact, impervious, mottled, stratified, etc., when applied to soil. Moreover, of late there has been adopted the use of foreign terms, some of which seems desirable while others ought to be discarded. It seems within the scope of this organization to have a committee to take up the consideration of enlarging and defining more exactly our soil terminology. The creation of such a committee is recommended.

In considering changes of the soil report proper, I would suggest first that the report be made what its name indicated--a soil report. Our present reports are as much agricultural and geographical reports as soil reports and because of this fact the study of soils as a science has not received its just recognition or deserved importance. We have been using too much material that belongs more to geology, geography, and history and because of this, attention has been diverted to a large extent from the main subject, which should be a complete soils discussion.

In proposing an outline for soil survey reports, I suggest the following order:

A. A short introductory chapter--this to include a brief description of the county or survey area as to its location and general topographic features. In giving the location all statements as to latitude and longitude and the names of bounding counties should be omitted. The general surface features should be described briefly. However, a description of the courses of streams and of all other minor cultural features that are shown on the soil map should not be included under topography. The native vegetation, industries and natural resources deserve mention as far as they have a relation to the agricultural conditions in the area. All historical data,

discussion of the roads, mail routes, etc., should be omitted. In brief, the introductory chapter should merely give a "birdseye" of the important natural features of the survey area.

B. The second chapter would be a general chapter on soils of the area. It is my opinion that this chapter should be the most important part of the whole report. It should be a really complete and comprehensive discussion of the soils as to their character, relationship and economic limitations. Some of the factors that might be considered are as follows:

1. The relation of the soils of the surveyed area to the larger region or adjoining areas. (Ex. Knox County part of N. E. Mo. level prairie region).

2. What are the general characteristics of the soils--as to color, texture, character of subsoil, content of organic matter, sourness, etc. This will be essentially a description of the generalized profile or profiles of the soils of the area. The cause of soil conditions as related to progressive soil development, origin, etc.

3. On the basis of soil character, point out which are the major and which the minor factors in soil classification. Each report should include a brief discussion on soil classification and nomenclature.

4. What is the relation of soil character to crop production? To crop adaptation or plant rotation? (Ex. Alfalfa on open subsoils.)

5. What is the relative importance of structure in its effect on crop yields?

6. Why is a given soil type or group of soils suitable to the production of specific crops?

7. What is the relation of soil character to moisture holding capacity?

8. How are soil conditions influenced by natural and artificial drainage?

9. To what extent can natural soil conditions be improved or modified in a practical way?

There are other topics that might be discussed that will vary according to local conditions of each survey area. It is essential that this chapter embody all the knowledge obtained on the soils of the area. It should not only describe the general soil conditions, but also explain as far as possible the cause for such conditions. The significance of the various soil conditions in their relation to the economic utilization of the soils should also receive due consideration.

It might be charged that such a discussion of the soils will be too technical for the general reader. I do not agree to this. When the survey of an area has been completed, the surveyor has a thorough knowledge of the

soils, and ought not have trouble to state in simple terms the information he has acquired. It is much less a matter of skill in popular composition than of clear thinking and plain expression.

C. Following the chapter on soils are the soil type descriptions. This part of the present soil reports seems satisfactory, although the discussion on minor soil variations frequently is too long. All soil management should be included under type descriptions. The value of the report would be increased considerably to have it include a discussion of the practical problems that are met in the management of each soil type with instructions regarding profitable soil treatment. The majority of farmers using soil reports will be interested primarily in the soil types on their own farm, and in order that all recommendations might be as definite and specific as possible, it seems best to discuss the soil management for each type (or group of similar types) even at the expense of some repetition.

It is evident that there are chances for errors and misstatements on soil management to creep in. An inexperienced or overenthusiastic report-writer might include matter that cannot be verified. To avoid errors of this sort, it is recommended that all soil reports should be submitted to the state authorities when the first draft of the report is completed by the field man--in all states where a cooperative arrangement exists between the Bureau and the State.

D. The chapter on agriculture coming next, should be a brief, general description of the agricultural conditions in the county with an interpretation of these conditions to the soil conditions. If the relationship of the agriculture to the soils is not defined, then the chapter on agriculture loses its real significance and has no place in a soil report. A deserved criticism of this part of soil reports is that it is given too much of mere description, much of it on unimportant or well known matter. Thus a discussion on the preparation of the seed bed, date of seeding, time of marketing, breeds of livestock, etc., should be omitted. More attention should be given to discussing the possibilities of expansion as well as the limitations of agricultural practices. Similarly, the possibilities for the introduction of new industries, and the growing of special and general crops should receive due consideration. In general, the Chapter on Agriculture should be interpretive rather than descriptive.

E. No special changes are suggested for the Chapter on Climate as it is now prepared. It seems desirable that in regions of extreme climatic conditions, the data on climate be even more complete. In every case, however, the discussion on climate should not be per se, but should define the relation of the climate to the soil and agricultural conditions. Following the body of the report may be added tables and charts on soil composition, data on crop yields, farm management tables, all of which should be an aid in interpreting the soils and agriculture of the survey area.

The summary now included in soil reports is of little value and ought to be omitted. Soil reports are unlike the average Experiment Station Bulletin which usually presents one or more conclusions. A summary of these is feasible and desirable.

One other feature of soil reports that deserves greater consideration, is to include more illustrative material. A few well chosen pictures will take the place of much description on topography and agriculture. Illustrations of representative soil sections or profiles would be an aid in defining soil structure and character. Even charts and diagrams to illustrate soil conditions seems desirable.

The adoption and use of such an outline for soil survey reports would add greatly to their usefulness and clearness and make them more nearly comply with the requirements of a real soil report. In a general way, the three principal parts of the report--the chapter on soils, soil types, and agriculture would meet the requirements of the three groups of readers. The investigator and student of soils would find in the general chapter on soils a complete record of soil information of the area. The chapter on soil types is mainly utilitarian or practical in its aspect, and would meet the requirements of the farmer. The general public is interested primarily in information on the relation of the soils to the agriculture of the area, and this would be supplied in the chapter on agriculture.

Discussion of Address - "Soil Survey Reports" - H. H. Krusekopf

"I agree with Mr. Krusekopf in the fore part of his suggestions, especially the elimination of the conclusions, and make a little more of the introductory chapter. In Banks or real estate offices you very rarely find a soil map. We are putting out some mighty good stuff if they would use it. Possibly one reason they don't use it, we don't put it in a form that they can readily get hold of it. If we could just give them a bird's eye view of the county as a whole so that they could get it sized up, we would get a whole lot of those people interested. I wish to note one very marked exception to this. The Missouri Savings Bank of Kansas City puts out as many loans or more than any institution in western Missouri. They use our reports constantly and find them of great help, but it seems to me that something should be done to put this line of good stuff where that class of people will use it more extensively."

Dr. Marbut -

"I am very much pleased to hear the paper as a whole. I think if it were adopted, it would be a good move in the right direction, especially the suggestion that the soils chapter should be much longer than it is now and should contain the greater part of the general description, and it seems to me in this connection, the soils chapter could very well start out by giving the high lights. In every region there is a predominant soil and that soil has a particular profile. In starting out the soils chapter, that dominant soil should be carefully described, its importance brought out. That dominant soil is usually the mature soil of the region and every other soil in the county is usually related to that one. The soils are either young, not developed, or the soils are old, and all the soils in the county could be described with reference to this mature soil. If that form of report should

be adopted, it would add a great deal to the value of our soil reports.

"The chapter on agriculture, relationships between soils and agriculture, is a good suggestion. I see no reason why the agriculture should not be described in that report. In order to interpret the agriculture it must be presented. The soils have been described, then the agriculture should be described and the two correlated. The main point is to put that in a place where it can be made into an interpretative chapter."

Dr. Conrey -

"If the discussion of climate is simply a statement of climatic data, it seems to me that here is an opportunity for interpretation. Two or three tables on rainfall and growing season are of very little value."

Dr. Condra -

"In regard to the climate, we have been thinking of putting a map in showing the isotherm lines, the number of growing days in the year, the first frost in autumn, the last frost in spring, in short, a bird's eye view of the weather of the county showing its relation to agriculture."

P. E. Brown -

"It seems to me that some of the suggestions are very good; however, I wonder whether the report put up in this shape will be more popular or more technical. These reports are to go before a certain group of people whose attention wants to be attracted, and if we are going to start putting a description of the topographic or physical characteristics of the area first, it is a question whether the people are going to read any farther. If the chapter on agriculture is put in the last of the report, you have taken away any possibility of getting a popular presentation of the report. You will notice that I am not saying that the Bureau report should be in a popular shape, but do you want the Bureau report put out in a more popular shape than at present or not? You must attract your audience by putting the chapter on agriculture first to make it more popular."

"How logical would it be to put a chapter on agriculture in a soil report?"

Dr. Brown -

"My relations with the agricultural press have impressed upon me very emphatically that you have got to attract the attention of the agricultural public, otherwise the public will not read the article."

H. L. Walster -

"After we have got all these reports written up, I would like to ask if our Committee on Legislation has considered any better schemes for getting

at and making available the federal reports? It is a matter of historic record that valuable reports have been lost, and what has become of them is a mystery."

Prof. Wiancko -

"I don't know exactly what ought to be done. I have noticed this time and time again, that our county agents, for instance, who ought to make use of these reports, don't do it to a large extent. Whether it is because he doesn't know how, or is it in a form so that he can't use it?"

"Have you ever polled the county agents on why they don't use it?"

Prof. Wiancko -

"Yes", a lot of them have the idea that there is nothing much in it,"

H. H. Lewis -

"This summer in the county where I have been working in New York, Mr. Baker, the county agent, has been very much interested in the soil survey of the county. He wanted to go out with us and that evening he said, "I am very glad to have gone, I have learned something. " Another county agent said he knew the soils in general but he was surprised to know that there were so many variations of the soils in that county. The various county agents are very anxious to go on with it, and find out what we are doing so that they can give it to the farmers."

Dr. Marbut -

"I move that we endorse the outline presented by Mr. Krusekopf."

Prof. Alway -

"There are a good many men here and there is a good opportunity for some model reports to be written, and if each one would take one of the Bureau reports and make their suggestions for putting that into model form, I think it would be a good plan."

M. H. Lapham -

"I have prepared a little paper myself dealing with this subject, but owing to the fact that I did not know that I would be able to attend the meeting until recently, I failed to get a place on the program. If there is time I would like to read it, if not, there are a few additional suggestions that I would like to make."

THE RELATION BETWEEN SOIL TYPE AND CHEMICAL COMPOSITION

By E. E. DeTurk, University of Illinois.

INTRODUCTION.

The distinguishing of soil types for purposes of mapping as well as for other purposes is based very largely upon those characteristics, mainly physical, which may be determined with a considerable degree of accuracy by examination in the field. There is no question as to the reliability of separations made in this way. While in some cases one type passes gradually into another, so that no sharp boundary line can be determined, in the majority of cases the type boundaries are fairly distinct. In a consideration of the productivity of soils, however, agronomic investigators place a varying but distinct emphasis upon the importance of chemical composition. The importance of the chemical composition of soils as a factor in fertility may be illustrated by the well known fact that many unproductive areas, as for example the "barrens" of Maryland, contain but a trace of those chemical elements known to be essential in the normal growth of plants, even though the soil and climatic environment in other respects are favorable to plant growth. In contrast to this, the corn belt of the Mississippi Valley may be cited. It is recognized, to be sure, that the total amount of plant nutrient elements in a soil is only one of several factors affecting its productiveness, and consequently, that chemical composition, alone, may not be taken as a reliable guide in the practice of fertilization.

SCOPE OF STUDY

With this viewpoint in mind, two questions come rather prominently to one's attention. These are:

- (1) To what extent do the soils within a given type vary in chemical composition, and is the variation entirely irregular, or does it progress in certain directions, due to climatic or other factors?
- (2) Is the variation within a given type less than or greater than the variation from one type to another; in other words, are there boundary lines between soil types with respect to chemical composition as there are with respect to physical properties.

Within the limited scope of this paper, it has become necessary to confine the discussion to a small number of soil types and of chemical elements, in order to give adequate attention to any one of them. Three soil types have been selected, which are extensive in Illinois, which are widely distributed over the state, and which very frequently lie adjacent to each other in the field. Thus, there is provided in the three types chosen, a possibility of gradation from one into the other. These types are known in the Illinois Soil Survey as yellow-gray silt loam, an undulating, upland timber soil, distributed throughout the state; brown silt loam, the typical undulating prairie soil of the corn belt, occupying much of the area north of the Shelbyville Moraine; and black clay loam, which occupies the more nearly level, and more poorly drained areas in the corn-belt

prairie. These soils probably correspond roughly with the Miami silt loam, Tama silt loam and Tama clay loam in the classification by the United States Bureau of Soils.

It is proposed to attempt to answer the two questions in part, with respect to organic carbon, total nitrogen and total phosphorus.

In the Illinois Soil Survey, soil samples of each type in a given county are analysed with respect to dry matter, nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, total carbon, carbonate carbon and lime requirement where the soils are acid. The organic carbon is obtained as the difference between total carbon and carbonate carbon. The soils from fifty-two counties have been analysed, the total number of samples of all types approximating 2000 for each of the three strata sampled, namely, 0" - 6 2/3", 6 2/3" - 20", and 20" - 40". In order to increase the number of analyses included in the individual averages, the counties were grouped as shown in Plate I, the boundary lines of the main soil areas being maintained, so that a given county may fall partly in two different groups. The shaded counties have been analysed. Thus each value given is the mean of varying numbers of analyses, ranging from 5 to 58.

VARIATION WITHIN THE TYPE

When individual samples are considered, the variation within a given type, even within a given county is very wide. This is illustrated by the following examples of minimum and maximum values, in the Upper Illinoian Glaciation:

	Organic Carbon			Total Nitrogen			Total Phosphorus		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Surface, Y.G.S.L.	11,020	26,500	43,880	1220	2320	3600	600	820	1100
" Brown silt L.	35,560	58,660	83,600	3200	4600	6380	860	1130	1500
" Black clay L.	46,860	67,210	93,180	3840	6060	7800	1000	1650	2460
Subsurf. Y.G.S.L.	5,540	10,930	21,380	700	1131	1780	520	720	1020
" Brown silt L.	15,500	34,730	57,980	1380	3054	4400	660	890	1480
" Black clay L.	29,680	36,330	71,180	2440	3344	3980	740	1312	1640

In other soil areas the results are equally striking. It is obvious that but little importance may be attributed to individual analyses. That this is true is indicated by the probable errors of individual analyses, which were found to be large, ranging from 5.8 per cent to 19.5 per cent of the mean, in a number of cases which were computed. The probable errors of the means, however, ranging from 1.6 per cent to 5.7 per cent of the respective means, indicate that the averages here used fairly represent the type.

In order to determine whether the variations within a type are progressive in any direction, the means were charted by means of rectangles arranging them roughly in order from the south to the north of the state, but preserving the groupings by main soil areas (glaciations). Since the range of mean annual temperatures and the total rainfall varies rather greatly between the two ends of the state, it was thought that possibly climatic conditions may have affected the soil composition. Some correlation in the surface soils is exhibited by the analyses as shown in Tables 1, 3 and 5, particularly with respect to nitrogen and organic carbon, both of which are indexes of organic matter. It will be noted that these elements decrease as we go southward, a phenomenon which may be accounted for by the temperature and moisture conditions being more favorable to rapid decomposition of organic matter. In the subsurface soils no such gradation occurs. The composition within a given type holds quite uniformly throughout the state.

Some differences are observed in the nitrogen and organic carbon content of the surface soils only, in passing from one soil area (glaciation) to another. They, however, follow the trend noted above of increasing from south to north, with the exception that a decrease occurs in the soils of the Late Wisconsin and Iowan.

The variation in phosphorus content of both the surface and subsurface soils is entirely irregular, with the one exception of brown silt loam surface. The apparent tendency to increase from south to north in this instance may be accidental.

The extent of variation within any of the types is wide. The increase of the maximum value over the minimum ranges from 25 per cent to 121 per cent, as illustrated in the following table.

Range of Mean Values for Organic Carbon, Nitrogen and Phosphorus

Soil	Organic Carbon			Total Nitrogen			Total Phosphorus		
	% incr. of Max. over			% incr. of Max. over			% incr. of Max. over		
	Min.	Max.	Min.	Min.	Max.	Min.	Min.	Max.	Min.
Surface, Y.G.S.L.	17830	30920	74	1720	2820	64	680	1020	50
" B.S.L.	47790	74420	55	3720	6320	70	990	1370	38
" Bl.Cl.L.	49720	96980	95	3900	8620	121	1200	1840	53
Subsurf. Y.G.S.L.	6910	12430	80	900	1200	33	630	990	57
" B.S.L.	28750	42090	46	2710	3440	27	810	1010	25
" Bl.Cl.L.	27870	49690	78	2550	3730	46	900	1420	58

The greatest variation occurs in the organic carbon content and the least in phosphorus. Surface soils exhibit more variation than subsurface soils by nearly 20 per cent. Of the three types studied, black clay loam varies most markedly and brown silt loam the least.

VARIATION BETWEEN TYPES

The extreme range of values as indicated by individual analyses would completely obliterate all "chemical" boundary lines between soil types. For the reasons stated above, the use of those values is not justified. A study of the average values as shown in Tables 1 to 6 shows a fairly sharp line of demarcation between yellow-gray silt loam on the one hand, and brown silt loam and black clay loam on the other, with respect to organic matter in the surface stratum as indicated by both nitrogen and organic carbon, but the line is rendered indistinct by a considerable degree of overlapping of values.

The phosphorus content of the surface soils increases gradually, but distinctly from yellow-gray silt loam through brown silt loam to black clay loam. The variation in phosphorus content of these soil types may be due in part to organic phosphorus accumulations in the surface stratum, since the difference in phosphorus content between yellow-gray silt loam and brown silt loam largely disappears in the subsurface. The black clay loam carries its phosphorus content well down into the subsurface, so that that type is rather sharply differentiated from the other two in the subsurface.

A study of the means, however, while it shows in general the differences between types does not give a reliable indication of the existence or non-existence of boundary lines between types with respect to chemical composition. A study of the frequency distributions seems to offer the best approach to this question and the relations are shown in (Tables VII to IX).

It will be noted that the line between yellow-gray silt loam and brown silt loam is particularly sharp with respect to organic carbon and nitrogen, in both strata, but that it is especially sharp in the subsurface. This can be explained in part by the fact that the natural surface stratum of brown silt loam extends well down into the subsurface as sampled, so that the subsurface samples approach the surface in organic matter content. On the other hand, the natural boundary between surface and subsurface of the yellow-gray silt loam coincides fairly closely with the arbitrary division line used in sampling.

It is obvious that there is no semblance of a division line between the brown silt loam and black clay loam soils in nitrogen and organic carbon, notwithstanding the fact that the latter soils contain, as a general average, notably larger amounts of these two elements.

In phosphorus content there is an evident differentiation between the three types examined, in the surface stratum, as shown by the separation of the modes, but the line is obscured by the overlapping of a large number of results. The differentiation disappears in the subsurface except in the black clay loam which stands out as distinctly above the other two in its content of phosphorus.

Plate I

Grouping of Counties for Study of Soil Analysis Data



Table I.

Yellow-gray silt loam

Summary.

Surface 0" - 6 2/3"

Soil Area No. on map	Name	Number of counties	Number of analyses	Total organic carbon lbs. per 2 million	Total nitrogen lbs. per 2 million	Total phosphorus lbs. per 2 million	Number			
1	Unglaciated	3	12	17,830	+522 **	1,720	+60 **	930	+23**	1
2	Lower Ill.	3	16	22,070	+703	2,020	+55	760	+22	2
3	"	4	23	18,800	+415	1,760	+30	760	+19	3
4	"	5	16	22,610	+1127	2,090	+10	800	+29	4
5	"	4	12	22,920	+844	2,220	+94	680	+41	5
Mean of Lower Ill.				21,230		1,980		760		
6	Middle Ill.	4	15	22,550	+579	2,060	+73	900	+35	6
7	Upper Ill.	3	17	24,930	+102	2,140*	+78	760	+18	7
8	"	2	12	27,590	+1907	2,450	+15	820	+27	8
9	"	4	15	27,100	+801	2,430	+60	890	+16	9
Mean of Upper Ill.				26,400		2,330		820		
10	Early Wis.	4	16	25,830	+104	2,310	+96	820	+31	10
11	"	4	11	30,920	+1459	2,820	+17	970	+39	11
12	"	4	9	30,860	+1648	2,600	+12	1020	+33	12
Mean of Early Wis.				28,640		2,540		920		
13	Late Wis.	3	8	25,450	+1587	2,350	+15	810	+29	13
14	Iowan	4	5	21,400	+669	2,010	+77	880	+30	14
Mean for type				23,940		2,180		830		

*n=16

**Probable error in Tables I to VI were determined by the use of Peter's formula.

P.E. of mean equals $0.6453 \frac{\text{Sum}(\pm d)}{n}$ in which Sum ($\pm d$) represents the sum of the deviations of all individual analyses from their mean, disregarding the sign.

Table II.

Yellow-gray silt loam

Summary

Subsurface 6 2/3" - 20"

Soil Area

No. on map	Name	Number of counties	Number of analyses	Total organic carbon lbs. per 2 million	Total nitrogen lbs. per 2 million	Total phosphorus lbs. per 2 million	Number
1	Unglaciatiad	3	11	6,910	+ 270	900	1
2	Lower Ill.	3	16	9,870	+ 491	1120	2
3	"	4	23	7,990	+ 191	910	3
4	"	5	16	8,540	+ 589	960	4
5	"	4	12	10,070	+ 579	1110	5
Mean of Lower Ill.				8,940		1010	
6	Middle Ill.	4	15	8,960	+ 380	910	6
7	Upper Ill.	3	17	12,430	+ 597	1170	7
8	"	2	12	10,220	+ 930	1100	8
9	"	4	15	9,800	+ 545	1120	9
Mean of Upper Ill.				10,930		1130	
10	Early Wis.	4	15	9,280	+2099	1100	10
11	"	4	11	10,140	+2715	1200	11
12	"	4	9	10,170	+ 563	1080	12
Mean of Early Wis.				9,780		1130	
13	Late Wis.	3	8	10,420	+ 437	1190	13
14	Iowan	4	5	8,300	+ 717	1040	14
Mean for type				9,500		1050	

Table III.

Brown silt loam			Summary			Surface 0" - 6 2/3"				
Soil Area										
No. on map	Name	Number of counties	Number of analyses	Total organic carbon lbs. per 2 million	Total nitrogen lbs. per 2 million	Total phosphorus lbs. per 2 million	Number			
6	Middle Ill.	6	27	50,030	+1062	3,960	+72	1,000	+21	6
7	Upper Ill.	3	7	47,790	+1222	3,720	+135	990	+29	7
8	"	2	17	49,740	+9028	4,130	+72	1,060	+24	8
9	"	4	36	64,910	+9516	4,990	+62	1,190	+13	9
Mean of Upper Ill.			60	58,620		4,600		1,130		
10	Early Wis.	4	58	56,360	+708	4,700*	+52	1,040	+11	10
11	"	5	58	59,790	+948	4,940	+80	1,090	+13	11
12	"	6	57	69,040	+1472	5,730	+134	1,370	+25	12
Mean of Early Wis.			173	61,690		5,120		1,170		
13	Late Wis.	5	25	74,420	+2656	6,320	+187	1,370	+23	13
14	Iowan	4	9	62,130	+2566	5,210	+254	1,220	+33	14
Mean for type			294	61,090		5,010		1,110		

* N = 57

Table IV.

Subsurface 6 2/3" - 20"

Summary

Brown silt loam

Soil Area

No. on map	Name	Number of counties	Number of analyses	Total organic carbon lbs. per 2 million	Total nitrogen lbs. per 2 million	Total phosphorus lbs. per 2 million	Number	
6	Middle Ill.	6	27	36,540	+847	2,890	+19	6
7	Upper Ill.	3	7	35,410	+978	2,710	+139	7
8	"	2	17	33,360	+394	2,790	+ 63	8
9	"	4	36	42,030	+917	3,440	+ 46	9
Mean of Upper Ill.				38,830		3,170		
10	Early Wis.	4	58	35,320	+502	3,100	+ 43	10
11	"	5	56	35,740	+597	3,100	+423	11
12	"	5	56	33,120	+740	2,960	+ 57	12
Mean of Early Wis.				34,730		3,050		
13	Late Wis.	5	25	35,400	+126	3,190	+126	13
14	Iowan	4	9	28,750	+176	2,720	+104	14
Mean for type				35,615		3,061		

Table V.

Black clay loam			Summary			Surface 0" - 6 2/3"					
Soil Area			Total organic carbon			Total nitrogen			Total phosphorus		
No. of Map	Name	Number of counties	Number of analyses	lbs. per 2 million	lbs. per 2 million	lbs. per 2 million	lbs. per 2 million	lbs. per 2 million	lbs. per 2 million	lbs. per 2 million	Number
6	Middle Ill.	4	12	61,320	+2709	4,940	+2352	1,320	+ 47		6
7	Upper Ill.	2	2	49,720	+ 246	3,900	+ 76	1,200	+169		7
8	"	2	4	70,530	+5771	5,960	+ 156	1,630	+439		8
9	"	4	5	71,510	+1109	7,000	+ 348	1,840	+ 11		9
Mean of Upper Ill.			11	67,210		6,060		1,650			
10	Early Wis.	4	20	75,320	+2386	7,030	+ 162	1,800	+ 26		10
11	"	7	32	75,740	+1555	6,990	+ 170	1,690	+ 49		11
12	"	4	8	79,240	+4144	7,090	+ 392	1,670	+ 92		12
Mean of Early Wis.			60	76,460		7,020		1,720			
13	Late Wis.	2	3	96,980		8,620	+ 837	1,830	+210		13
14	Iowan	None	--	--	--	--	--	--	--		14
Mean for type			86	73,880		6,660		1,660			

Table VI.

Black clay loam		Summary					Subsurface 6 2/3" - 20"	
Soil Area		Total organic carbon		Total nitrogen		Total phosphorus		
No. on map	Name	Number of counties	Number of analyses	lbs. per 2 million	lbs. per 2 million	lbs. per 2 million	lbs. per 2 million	Number
6	Middle Ill.	4	12	34,660	+1665	2840	+108	940
								+ 55
7	Upper Ill.	2	2	33,700	+3229	2550	+ 93	900
8	"	2	4	45,530	+2085	3680	+976	1420
9	"	4	5	49,090	+ 374	3730	+ 57	1370
								+ 43
Mean of Upper Ill.			11	45,290		3500		1300
10	Early Wis.	4	20	35,620	+ 158	3330	+ 97	1320
11	"	7	32	37,600	+ 116	3420	+ 94	1320
12	"	4	8	32,990	+1417	3080	+122	1260
								+ 24
Mean of Early Wis.			60	36,330		3340		1310
13	Late Wis.	2	3	27,870	+3956	2870		1200
14	Iowan	None	--	--	--	--	--	--
								14
Mean for type			86	36,130		3200		1250

Table VII.

Frequency Distribution - Organic Carbon

Surface

Soil Area	Yellow-gray silt loam											Brown silt loam											Black clay loam										
	1	2	3	4	5	6	7	8	9	10	11	6	8	9	10	11	12	13	6	10	11												
Values, lbs. per two million																																	
0 to 10,000				1																													
10,000 to 20,000	10	6	17	5	3	5	4	2	1	4																							
20,000 to 30,000	2	9	6	9	9	9	10	5	10	8	8																						
30,000 to 40,000	1			1		1	3	4	4	4	1	3	1																				2
40,000 to 50,000								1			2	12	7	1	12	15	7																
50,000 to 60,000												10	9	11	29	12	13	6	3	4	1												
60,000 to 70,000												1		15	12	21	13	6	4	3	11												
70,000 to 80,000												1		6	4	7	11	3	2	7	10												
80,000 to 90,000														3	1	2	8	7	1	2	5												
90,000 to 100,000																1	4			1	1												
100,000 to 110,000																	1			2	2												
110,000 to 120,000																	1			1	1												
120,000 up																	1																

Table VIIa.

Frequency Distribution - Organic Carbon

Subsurface.

Soil Area	Yellow-gray silt loam										Brown silt loam										Black clay loam									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Values, lbs. per two million																														
0 - 5000				1			1																							
5000 - 10,000	11	8	19	9	5	9	3	6	9	11	5																			
10,000 - 15,000		8	3	6	6	6	9	5	4	4	5																			
15,000 - 20,000					1		3	1	2		1																			
20,000 - 25,000							1																							
25,000 - 30,000																														
30,000 - 35,000																														
35,000 - 40,000																														
40,000 - 45,000																														
45,000 - 50,000																														
50,000 - 55,000																														
55,000 - 60,000																														
60,000 up																														

Table VIII.

Frequency Distribution - Nitrogen.

Surface.

Soil Area	Yellow-gray silt loam											Brown silt loam											Black clay loam										
	1	2	3	4	5	6	7	8	9	10	11	6	8	9	10	11	12	13	13	6	10	11											
Values, lbs. per two million																																	
0 - 1000																																	
1000 - 2000	10	9	20	7	4	7	5	5	2	5	2																						
2000 - 3000	2	7	3	8	8	7	11	4	12	9	6	1																					
3000 - 4000				1		1		3	1	2	2	11	8	1	6	6	2																
4000 - 5000										1		14	9	23	39	26	17	3															
5000 - 6000												1		10	9	19	18	11															
6000 - 7000														2	3	6	10	3															
7000 - 8000																1	3	5															
8000 - 9000																	4	1															
9000 - up																	3	2															

Table VIIa.

Frequency Distribution - Nitrogen.

Subsurface

Soil Area	Yellow-gray silt loam											Brown silt loam											Black clay loam					
	1	2	3	4	5	6	7	8	9	10	11	: 6	8	9	10	11	12	13	: 6	10	11	:	:	:	:	:	:	
Values, lbs. per two million																												
0 - 500																												
500 - 1000	7	5	19	11	6	8	5	6	5	4	2																	
1000 - 1500	4	9	4	3	4	6	10	4	9	11	7																	
1500 - 2000			1		2	2	1	1	2	1	2						1	1									1	
2000 - 2500													4	2	7	7	13	3	2								1	
2500 - 3000												13	6	4	18	13	19	10	3	7	10							
3000 - 3500													8	6	18	22	26	11	5	3	7							
3500 - 4000													1	1	10	10	8	7	4	1	6							
4000 - 4500													1		4	2	2	6										6
4500 - 5000																											2	2
5000 - up																												

Frequency Distribution - Phosphorus

-147-

DISCUSSION

"A Study of the Relation between the Soil Type and Chemical Composition"

E. E. DeTurk.

Mr. Bushnall -

"Isn't it true that in the case of the brown silt loam below 6 2/3 inches, it contains soil as black as the surface 6 2/3 inches?"

Dr. DeTurk -

"Yes, that is very true, the uniform brown color extends down 10 to 12 inches."

"If we had a chart in which the comparison showed total organic carbon in the natural soil layer and then compared the natural subsurface layer, for instance, the contrast between the two layers would not be so strong, would it?"

"No, that would disappear, I think. I should judge that the organic matter would drop down far below this value if we took the natural layer."

Dr. DeTurk -

"That sharp contrast would disappear if we took the natural layer."

"Would the same thing apply to the content of calcium? Would the brown subsurface layer show a higher degree of acidity or lesser in brown silt loam?"

Dr. DeTurk -

"We find variations going in both directions. A layer to a depth of 15 inches contains soil carbonate. Nearly always there is carbonate in the till. Some types of brown silt loam contain carbonate in the surface layer and would be called alkali spots. Most of the soils of the surface layer of brown silt loam will grow clover. The Hopkins soil acidity test gives variations from 200 to 800 pounds of lime requirement in the surface soil. Around 600 pounds would be the average."

Dr. Marbut -

"Is the brown silt loam represented by the higher land between here and Danville?"

Dr. DeTurk -

"When we get about half way over there is quite a little timber, but if you exclude the timber area, much of it would be brown silt loam. This corresponds to the Tama silt loam."

Dr. Marbut -

"The Tama is really nothing but loess, it is derived from loess, is rich, and has a well-drained, oxidized subsoil."

"Wouldn't there be any Brookston?"

Dr. Marbut -

"I don't know how the soils of Illinois would run."

ADDRESS

By Charles A. Stanton, President of the Agricultural Appraisal Company.

Mr. Chairman--Ladies and Gentlemen of the American Soil Survey Workers' Association:

In discussing such an important subject as "The Classification of Soils for Commercial Purposes," I think I had better tell you in advance that I am not a soil expert and that I am only an ordinary farm appraiser with the unusual experience of having appraised farm property in nearly every agricultural section of our great country. While that appraisal experience has given me a fair knowledge of soils for practical purposes, yet, I make it a rule never to appraise farm property without the aid of a competent soil man. I believe that the quality and fertility of the soil is our only sound basis for permanent farm land valuation and that a classification of our soils for commercial purposes must be made before we can stabilize our farm land values and better our commercial treatment of farm property. In the discussion of this subject I am going to confine my remarks to the answering of three questions, (1) What is the value of Soil? (2) How can soils be Classified for Commercial Purposes? and (3) Why Should Soils be Classified for Commercial Purposes?

In answering the first question--What is the Value of Soil?--I might tell you that the soil produces everything of material value, or I might tell you that our only two forms of life, namely, plant life and animal life, both owe their existence and maintainance to the soil, but, such facts will not get us anywhere. It would only lead us around a circle and to the Biblical teaching of the fact that "the dust shall return to the earth as it was," which is something we all know. Perhaps the value of soil could best be told in figures showing the billions of dollars produced annually in farm products, but that is statistical and also something we all know. So in answering this question, I am going to refer only to the practical agricultural value of the soil for commercial purposes. To the average man, soil is nothing more than dirt and something that he comes in contact with every day. Excepting the air we breathe and the water we drink, soil is the most common thing we have and the fact that it is so common is where its greatest value lies. Soil is described as being a finely divided rock material mixed with decayed vegetable or animal matter and constituting that portion of the surface of the earth in which all plants grow and fruit. It is not only the home of the plant, but, the machinery that produces the plant and its value exists in its power to produce a plant of value. But the soil alone cannot produce. It must have (1) a satisfactory growing climate and (2) a proper moisture treatment. Climate is something that we cannot regulate, it being an element of nature over which man has no control. So all we can do, and we are doing that very efficiently, is to take the rainfall, temperature and sunshine records for a period of years and determine therefrom a dependable average growing season in every established agricultural section. Moisture for both surface and subsurface soils is something that we can control by either a natural or an artificial drainage system. So the value of the soil can and must be based upon a dependable growing season and a proper moisture treatment. When we know the chemical and physical properties of the soil and its growing season we can easily find its agricultural value and from that agricultural value we can deter-

mine the commercial value. Soil produces by a slow process of nature. Over 95 per cent of our staple crops have only one yield per year. Every line of business has a certain percentage of losses and failures. Nearly all of our mercantile and industrial enterprises have enough turnovers within one year to take care of their losses and failures out of the turnover results of the same year. Such is not the case with the soil where the failure of one crop means the failure of the results of a year. In order to give the value of soil the same consideration given to the value of mercantile and other industrial properties, we must consider the crop results of more than one year, so that a percentage of the crop failures can be established and the average results obtained. It is incorrect to discredit the value of the soil just because it fails to produce a full crop one year or fails completely another year. We must keep in mind the fact that the fertility of the soil can be maintained by fertilizing and rotating and that its proportion of failures to turnovers is not any greater than that of any other business and that the average results during a period of crop turnovers is just as dependable as the average results in any other line of business. Our failure to fully understand this principle is the only reason the value of the soil has not received the same commercial recognition given to other dependable properties. The average investor who thinks only in terms of fixed annual dividends is always ready to condemn the soil when it fails to produce promptly within the year. He does not look beyond the year and does not consider the fact that the soil, like other producing properties, is entitled to its percentage of losses and failures in a given number of turnovers. Had the investing public given the value of soil the consideration of more than one turnover and the full benefit of the average results for a period of years instead of the temporary results of one year, the convertible status of farm property would have long ago been established and there never would have been any need of the United States Government lending its credit to the farmer. The value of soil must be based upon not less than ten turnovers, which means that we must take into consideration not less than ten crops during a period of ten years. Recognition of this fundamental principle will prove that the soil has a more dependable commercial value than any other thing of material value.

In answering the next question--How can Soils be Classified for Commercial Purposes?--I am mindful of the fact that I am attempting to discuss a subject to which all the members of this Association have given considerable study, and were it not that the soil is so common that it is possible to solve some of its problems by ordinary thought, I would not attempt the task, especially before the largest and best organization of soil men in the world. I shall, therefore, ask you to consider the formula which I am going to offer in answer to this question as being more of a tentative plan for study and improvement rather than a definite solution of the problem. To begin with, there are three things of fundamental importance I shall ask you to keep in mind: First--That the classification of soils for commercial use is not a one-man job, and that it is a business proposition involving the work of man and nature, which in my opinion requires the combined services of four professional men, as follows: The Soil Surveyor, who must determine the different types of soil according to formation, texture, structure, drainage, depth, color, etc.; the Soil Chemist, who must determine the chemical and physical properties in the soil and its agricultural requirements; the Weather Man, who must provide the rainfall, temperature and sunshine records of a given area and determine

therefrom a dependable average growing season for that area and the Statistician, who must find the average prices, yields, costs and failures of the staple crops grown in a given area and determine therefrom the commercial value of each type of soil in that area. Second--That the Classification of Soils for Commercial Purposes must be divided into agricultural districts having uniform geological, topography and climatic conditions. This division is necessary not only because the same soil will produce differently in different growing seasons, but, because the producing power of every type of soil depends entirely upon the growing season. The size of these agricultural districts, which for the benefit of this discussion I will hereafter refer to as "area," may run anywhere from a small valley of a few square miles to a territory covering one or more States. Third--The Classification of Soils for Commercial Purposes must not be regarded as a classification of farm land values since the soil is only a part and not the full value of the farm. The value of the soil represents the productive value from which the full value of the farm is determined by location, improvements, environment, and other governing factors in farm land valuation. Now, my formula for the classification of soils for commercial purposes is substantially this:

(1) We must base the classification upon the following:

- (a) The proper moisture treatment of both surface and subsurface soils either by a natural or an artificial drainage system. (If there should be too much water or not enough water in the soil, it is not the fault of the soil since the remedy, excepting in arid sections that cannot be irrigated, is within the power of the individual.)
 - (b) The proper cultivation of the soil for the crop to which it is best adapted. (If the farmer in charge has not the ability nor energy to cultivate the soil properly, the soil should not be held responsible since there are other farmers who can cultivate it properly.)
 - (c) The proper development and upkeep of the soil by fertilizing and rotating. (The soil must not only be cleared and kept in good condition to maintain its value, but protected against overflow and other destructive surface elements.)
 - (d) The average yield, average price, average cost of production and average percentage of failures for a period of ten years of the principal crop to which the soil is best adapted.
- (2) We must analyze every important type of soil and make a business and inventory-like statement of all its physical and chemical properties and characteristics, including its origin, formation, texture, structure, acidity, depth, color, drainage, adaptation and requirements.
- (3) We must find the average price, average yield, average cost of production, and average percentage of crop failures of every marketable staple crop in each area for a period of ten years or more.

- (4) We must find the soil requirements of every staple crop grown in each area and from these requirements adopt a type of soil for each staple crop, to be used as a standard soil for the classification.
- (5) We must multiply the average price of the staple crop by the average yield of the standard soil and deduct from the results the average cost of production and percentage of failures to determine the average annual net income per acre of each standard soil.
- (6) We must multiply the average annual net income by ten to determine the commercial value of the standard soil and all the other soils of the area grouped under that standard soil.
- (7) We must limit the classification in each area to the number of staple crops grown in the area so that an area having, say, 100 soils and five staple crops will not have more than five standard soils and five different values.

The Classification of Soils for Commercial Purposes is a simple proposition when you understand the fundamental business principles upon which the classification should be made and when you strip the soil of all its unnecessary technical environments and give it a purely business consideration. Of course, we must know the contents and characteristics of the soil to find its full agricultural value, but, when we once determine that agricultural value there is no difficulty in finding the commercial value. There are only three main factors to deal with--Soil, Crop and Climate. Of the three, the Crop is the only factor that has any direct contact with a market value. While the agricultural value of the soil must be determined by its power to produce the crop, yet, the commercial value of the soil must be determined by the value of the crop. For this reason we must group the soils according to crop adaptation. We cannot adapt the soil to the crop and climate because that is not entirely practical, and we cannot adapt the climate to the crop and soil because that is not possible. But we can adapt the crop to the soil and climate, and in order to do this efficiently we must find the soil required for each staple crop and use that soil as a standard for the classification. According to the Bureau of Soil Bulletin No. 96 there were 1,650 types of soils in the United States recognized up to 1912, which number has probably been increased to about 2,000 since that time. According to the 1920 census report, we have in the United States approximately 503,000,000 acres of tillable soil under cultivation. Of this acreage we have approximately 350,000,000 acres in five crops--corn, wheat, hay, oats and cotton, and approximately 50,000,000 acres in nine crops--barley, rye, tobacco, potatoes, rice, peanuts, cane, beets and buckwheat. The remaining acreage, approximately 103,000,000 acres, is divided into more than 200 varieties of fruit and vegetable crops. So in the classification of approximately 2,000 types of soil in the United States we have for our first consideration five big important crops covering about 70 per cent of the acreage, for our second consideration nine less important crops covering about 10 per cent of the acreage, and for our last consideration the 200 small remaining crops covering about 20 per cent of the acreage. This means that the first five and next nine staple crops will dominate the classification and limit all the soils in the United States to fourteen basic values. Of these fourteen it is not likely that



there will be more than six or seven values in any one area. In the early part of this year the Agricultural Appraisal Company of Columbus, Ohio, undertook the classification of the soils in Ohio for commercial appraisal work. Up to the present time we have recognized 155 soil types which we have grouped into six different basic values. All the organic and bottom soils have been placed in one group and valued at \$100 per acre, which is the highest value in the classification, and all the inorganic and upland soils have been placed in five groups with five values running from \$40 to \$85 per acre. Our success in bringing all the soils of the State into one general classification has been due largely to the fact that Ohio happens to have a uniform condition with respect to both climate and soil texture. With the exception of a slight difference in the temperature of the lake counties on the north and the river counties on the south, the growing climate is practically the same all over the State, and with the exception of a few small areas of heavy clay and sand practically all the soils in the State are silt loams or silty clay loams. As we proceed in the development of our detail classification by counties like the Marion County Classification, it is very probable that we will have to divide the State into two classification areas. If we do this it will be entirely for geological reasons, since the State happens to be in three important soil provinces, namely, the Glacial Drift, the Glacial Lake, and the Appalachian Plateaus. The division will probably bring all the glacial and limestone soils of the lake counties and the northwestern half of the State into one classification area and all the non-glacial and shale and sandstone soils of the river counties and southeastern half of the State into another classification area. If we divide Ohio into these two areas, which I am sure we will have to do, and we take the climatic and geological formation of these two areas as our guide for a national classification, the estimated number of areas that will be required to make a complete classification of all the soils of the United States will be as follows:

REGION OR PROVINCE	COVERING
(1) Pacific Coast Region. 15 Areas	(All of the Pacific Coast States west of the Cascades, Sierra Nevada and San Bernardino Mountain ranges.
(2) Northwest Intermountain and Great Basin Regions. 11 Areas	(Eastern Oregon, eastern Washington, southern Idaho, western Utah, southern California, and all of Nevada.
(3) Southwest and Arid Regions. 3 Areas	(The extreme southeastern corner of California, southern Arizona, southern New Mexico and that portion of Texas south of New Mexico.
(4) Rocky Mountain Region. 20 Areas	(Northern Idaho, western Montana, western Wyoming, eastern Utah, western Colorado, northern Arizona and northern New Mexico.

- (5) Great Plains Region.
6 Areas (Southeastern Montana, eastern Wyoming, eastern Colorado, eastern New Mexico, southwestern North Dakota, western South Dakota, western Oklahoma, northwestern Texas, and practically all of Kansas and Nebraska.
- (6) Glacial Lake Provinces.
5 Areas. (Red River Valley of North Dakota and Minnesota and small areas in States bordering the Great Lakes.
- (7) Glacial and Loessial Provinces.
17 Areas. (Eastern parts of the Dakotas, eastern Nebraska, practically all of Minnesota, Wisconsin, Iowa, Illinois, Michigan, Indiana, western and northern Ohio, all of New York excepting the Lake Counties, northern Missouri, northeastern corner of Kansas, all of the New England States, northeastern Pennsylvania, and the western parts of Kentucky, Tennessee and Mississippi bordering the Mississippi Valley.
- (8) Limestone Valleys and Upland Provinces.
5 Areas. (Central and western Kentucky, central and eastern Tennessee, and a narrow strip of territory running from northeastern Alabama to southeastern Pennsylvania, northern Arkansas and southern Missouri.
- (9) Appalachian Mountain and Plateau Provinces.
5 Areas. (Greater part of Pennsylvania, southern Ohio, all of West Virginia, eastern Kentucky and western North Carolina.
- (10) Piedmont Plateau Provinces.
4 Areas. (Northern New Jersey, southeastern Pennsylvania, northern Maryland, western Virginia, central North Carolina, northwestern South Carolina, northern Georgia, and a small part of eastern Alabama.
- (11) Atlantic and Gulf Coastal Plains Provinces.
12 Areas. (Southern Arkansas, eastern, southern, and southwestern Texas, all of Louisiana excepting the Mississippi Delta, all of Florida, all of Delaware, eastern Mississippi and the southern parts of Alabama, Georgia, Virginia, Maryland, New Jersey and the Carolinas.
- (12) River Flood Provinces.
2 Areas. (Mississippi Delta in Arkansas and Louisiana.

In all there will be not less than 105 classification areas in the United States, and all the soils in each area will be limited to fourteen groups and fourteen basic values. About 80 per cent of these areas will not require more than six groups and six basic values, which is the present limitation of our Ohio classification.

I will now proceed to answer the last question, Why Should Soils be Classified for Commercial Purposes? In answering this question I am going to direct your attention to the farm land situation of our country and tell you why I believe our modern farm land problems cannot be entirely and successfully solved until we classify our soils for commercial purposes. Fifty years ago we had plenty of free government land and an undeveloped West to draw upon for our surplus population. In those days a horse could be traded for a farm and there was no need of any commercial recognition of soils. Today the situation is quite different. All of our best agricultural lands are privately owned and our population--exceeding 110,000,000--is now growing at the rate of 1,500,000 people per year. The time has come, therefore, when we must take stock of our resources and figure on the future distribution of our rapidly growing population. As matters stand today, about 40 per cent of the farmers of the United States are tenants and this percentage is increasing every year, which means that we are gradually drifting towards a peasantry condition, that is contrary to the basic principles of our great Republic. Now, regardless of all that we have done or may do by legislation or otherwise, we cannot ignore the fact that the future distribution and settlement of our farm lands is a purely private commercial proposition. This means that we must not only have a better commercial treatment of farm property, but base that commercial treatment upon a constructive land settlement policy that will promote farm ownership upon terms and conditions that are commensurate with the character and fundamental purposes of our basic industry. Easy opportunity for farm ownership which started and ended with the final distribution of our best public lands must be continued today in a commercial form, otherwise we will not be able to maintain our farming population and our high standard of modern farm life. In other words, if we expect to maintain our productive population we must give the man who cultivates the soil an opportunity to buy a farm under conditions and terms that will enable him to remain on the farm and become a farm owner by his own labor. How to accomplish this with safety to the investor and satisfaction to the farmer is the problem before us. I claim that it can be accomplished and that it will prove a good business proposition when we classify our soils for general commercial use and develop the convertible status of farm property. The apparent simplicity of our farming operations, leading everybody to believe that they know as much and more than the other fellow about soil fertility and farming generally, is the underlying disturbing influence of our whole farm land situation. As a matter of fact we all think we know so much when we know so little about soil and farming that we necessarily follow the temporary results before us instead of the general and permanent results that should govern farm-land valuation. The average investor gets his idea of the value of a farm from either an isolated experience of his own or from the experience of those near him. He does not stop to consider the fact that all our crop failures, crop fluctuation, labor troubles and other difficulties in farming operations are not any greater than the difficulties of our best-organized industries. The absence of a recognized standard for farm-land valuation, which is possible only by a classification of our soils for commercial purposes, is the very reason why every investor and even our govern-

mental agencies are obliged to fix farm-land values differently for their own purpose and protection. Appraising farms by various methods without any regard for the fundamental purposes of our farming industry is largely responsible for most of our farm-land difficulties and the main cause of all our unnecessary speculation and fluctuation in farm-land values. The remedy is not in an organized market for the sale of farms or the expansion of land credit. It is in a recognized basis for farm-land valuation by which we can develop the convertible status of farm land and give the farmer an opportunity to improve his financial standing and better his methods of doing business. Our present methods, unfortunately, are more of a peasantry treatment than a business enterprise. The average farmer is more concerned in the recognized value of his farm, which enables him to control his credit and protect his equity savings, than he is in the credit itself. When we hear of farm-land values going up or down because of some activity in the sale of farms, or in the sale of farm products, we should stop and investigate the cause of that activity before accepting it as a natural increase or decrease in farm-land values. While the demand is an important factor in any commercial valuation, yet in the valuation of farm land we must not overlook these facts:--(1) That farm land has a permanent economic value and is not a consumed product; (2) that our soil area will never increase while our population will always increase; (3) that it is the slow growth of our farming population that should regulate the demand for farms and not our speculative and widely fluctuating prices of farm products; and (4) that a farm is as much a home as it is a business and that these two factors must be given full consideration. Failure to sell farms under our existing practice does not always mean that there is no demand for farms since our present selling methods are not within the reach of the so-called "dirt" farmer or the man who tills the soil. Selling farms for cash or upon short terms is all right for the few who have succeeded in saving their earnings for that purpose, but not fair to the many who have not been able to save and who want that opportunity for saving while engaged in farming. A real estate operator recently told me that only one man out of five who wanted to buy farms and engage in farming was able to meet his selling requirements, notwithstanding his offer of the Government long-time credit up to 50 per cent of the land and 20 per cent of the improvements. The experience of this real estate man is typical of the situation in every agricultural section. There are plenty of people qualified for farming who would buy farms were the right opportunity for purchase open to them. The incentive to own a home is the thing that will move the average man to work and become a better citizen. That incentive must be encouraged and promoted in the country as well as the city. In a farm we have both the home and business of the man who cultivates the soil, but unlike the man in the city, the man on the farm must own his business in order to own his home. The dollar-down-and-dollar-a-week principle which has done so much to promote home ownership in our cities and industrial centers, must also be used to promote farm ownership in our rural sections, although the application of that principle to a proposition which involves both the home and business of the individual calls for a different and better commercial treatment than that given to city property. The value of a city lot is based entirely upon location, while the value of farm land is based upon the fertility of the soil in addition to location. Determining a value by location is a simple mathematical proposition, but determining a value by the fertility of the soil is another matter. I claim that as soon as we classify our soils for commercial purposes and stabilize our farm land values, we can then develop a

better commercial treatment of farm property and solve the problem of farm ownership for the man who cultivates the soil. It matters not how constructive the plan of operation may be for the settlement of new lands or for the resettlement or development of established farming communities, we cannot get away from the fact that it is the quality and fertility of the soil that governs the situation. The solution of the whole farm-land problem, in my opinion, depends largely, if not entirely, upon a better understanding of soil fertility and farm work. We do not, I am sorry to say, properly appreciate modern farming and the wonderful possibilities it offers today. A few generations ago work on the farm represented 100 per cent manual labor and about 25 per cent of the then known comforts of life. Today, when 75 per cent of the work on the farm can be done by machinery, the situation is reversed. Farming now represents 25 per cent manual labor and about 100 per cent of our existing comforts of life. A few months ago a labor expert and I figured that the man who played golf one-half of the year for exercise actually spent more physical energy than the man who cultivates forty acres of land under modern conditions. We also figured that King Solomon in all his glory and all the kings and potentates from his time down to our present generation never had all the living advantages, comforts and enjoyments in life that are today open to the average American farmer. And yet the American farm is not producing one-half of what it is capable of producing. It is not being improved for the permanent use it offers. It is not given the commercial treatment it is entitled to. And it is not understood and appreciated as it should be. There is plenty of room for improvement. All the progress made since the days of the spindle, scythe and ox team is not one-fourth of the progress that is yet to come. The tractor, automobile, and highway, electricity, radio and other modern conveniences are rapidly revolutionizing American country life and making it the best the world has ever known. The isolated farm is rapidly passing away and the farmer who has the ability and energy to take advantage of all the opportunities open to him is going to enjoy a contented life of happiness and prosperity that has no equal. There are just two things we must do, and they are: (1) Promote public confidence in farm land values, and (2) educate the people to a better understanding of farm work and farm life. To do these things we must know more about the soil. That is why we should classify our soils for commercial purposes. Thank you.

DISCUSSION.

Classification of Soils for Commercial Purposes - Charles A. Stanton

"I would like to ask how your appraisal value compares with the selling price in Ohio."

Mr. Stanton -

"At the present time it runs a little bit more, but we pay no attention to the selling prices of farms."

SOIL STUDIES IN MICHIGAN

By M. M. McCool and J. O. Veatch.

The paper here presented contains in a brief and preliminary way the results (both theories and facts) of field and laboratory study in soil morphology and soil geography for the State of Michigan during the past year. This work constitutes a part of the research which the Soils Section of the Michigan Agricultural Experiment Station is conducting in connection with the Soil Survey work in the State. The writers are firm in the belief that work of this nature should precede or go hand in hand with the detailed studies, since by so doing the work as a whole may be closely correlated. Our work has been in a large measure an attempt to apply the concepts and observations of the Russian podologist, Glinka, and other European investigators, and those of Dr. C. F. Marbut of the U. S. Bureau of Soils. These are in essence: soils in their broader features are a function of climate; the soil is a separate entity and is capable of being classified on the basis of its own intrinsic characteristics; the proper study of soils should proceed by means of profile analysis, the determination of the separate members, horizons, for the whole soil thickness, the arrangement, physical characteristics and composition of each.

In an extensive reconnaissance, observations were made from the extreme southern to the northern end of the State. The observations were restricted mainly to virgin soils while the complete profile or whole thickness of soil weathering, from the surface to the practically unaltered geologic substratum, was taken into consideration. In collecting samples, these were taken to represent the different horizons present, whatever their thickness or depth. Arbitrary distinctions as to soil and subsoil and the method of collecting samples according to fixed depths or at fixed intervals were discarded from the outset as being unsuitable for the purposes of these studies, since the primary object was to determine whether it might be practicable in soil classification work to recognize separate horizons and whether these possess physical and chemical qualities which are constant in a general way. Observations were necessarily confined to relatively mature or old soils.

On the basis of our work, so far as conducted, we believe that two broad groups of the rank of climatic soil provinces should be recognized in the State. For the present we are designating these simply as: (1) Northern group and (2) Southern group.

The comparative description of these two groups is briefly presented. The profile of the soils of the Northern group consists of the following horizons which appear to be universally present but variously modified by texture, topography, vegetation and nature of the parent inorganic material or geologic base.

1. Surface horizon of forest mold.
2. Gray or ashy soil - the podsolized horizon.
3. Brown horizon-color and peculiar character due mainly to colloidal organic matter.

4. Horizon of inorganic soil showing variable degrees of iron oxide coloring.

5. Substratum or geologic formation.

True humus soil is practically absent or attains only a minute thickness; the surface mineral soil is gray; there is a relatively sharp line of separation between horizons 1 and 2 and 2 and 3.

The profile of the Southern group is:

1. Horizon of mold and humus soil.

2. Horizon of brownish and yellowish soil.

3. Horizon of maximum clay and maximum intensity of coloring from iron oxide.

4. Gradational soil of small thickness, showing decrease in colloidal matter and decrease in iron-oxide coloring; layer of small thickness.

5. Geologic substratum.

The surface mineral soil is brownish; the gray and brown horizons of the Northern soils are only faintly developed or are entirely absent; a horizon of maximum clay, which possibly represents colloidal concentration, No. 3, is more strongly developed and the horizons are not as sharply separated from each other as in the Northern group.

Chemical and physical laboratory determinations of samples from representative profiles for the two major soil groups are given in the accompanying table.

On the basis of these analytical results and of a large number of other determinations which are not given here because partial and incomplete, it appears that the following generalizations might hold. For the Northern group, the silica is markedly higher in the gray (podsolized) horizon than in the brown horizon; the iron and alumina together are markedly higher in the brown horizon than in the gray horizon; the nitrogen is highest in the surface horizon, thence there is a decrease in the gray horizon, followed by an increase in the brown horizon or at least no appreciable decrease. In the Southern group it appears that there is a gradual decrease in nitrogen from the surface downward.

In both the Northern and Southern groups the humus soil (excluding leaf litter and raw forest mold) and the substratum show the higher pH or lesser degree of acidity than the intermediate horizons. In neither province is there any certain evidence of a consistent gradual increase in pH with depth. In the Northern Group where the brown horizon is conspicuously marked the pH generally reaches the lowest point. In the Southern Group the lowest pH in certain profiles which have the horizon of clay concentration strongly developed, may be within a leached horizon of small thickness resting directly upon the clay. In general it appears that there is an increase in total bases with

depth from the surface, but that this is not a constant gradual increase.

It is doubtless true that the soil expresses its physical characteristics quite well by its behavior toward water. Such characteristics as texture, structure, amount of colloidal matter and organic matter, activation of surface of soil particles and other things tend to reveal themselves, by such behavior. The phenomena of the heat of wetting and unfree water are in the main the resultant and expression of these characteristics. Now, if such is the case and if the soils of the Northern and Southern Groups are different with respect to their horizons, it logically follows that investigations of their values for heat of wetting and unfree water should reveal them to be different.

These values, for a large number of horizons from each group, have been obtained. They bring out that the sand soils in the Northern Group have the highest heat of wetting and unfree water in the first horizon; they are low for the gray horizon while for the brown horizon they are considerably higher than for the gray. With respect to the sand soils of the Southern Group these values are highest for the surface horizon thence show a constant decrease in the lower horizons. However, in the Southern Group there may be also a marked increase in the heat of wetting in a subsurface horizon, the horizon of maximum clay, but this is not at all comparable to the brown horizon of the Northern soils.

To summarize it is our opinion that the separate horizons, of the profiles, which can be differentiated in the field, will be found each to possess peculiar physical and chemical characteristics. It follows that their recognition cannot be ignored in soil classification.

Possibly further field studies and analytical work on a greater number of samples may not uphold in entirety the conclusions here presented. However, it is felt that investigational work of this nature is of fundamental importance in working out a sound scientific system of soil classification.

SOUTHERN GROUP

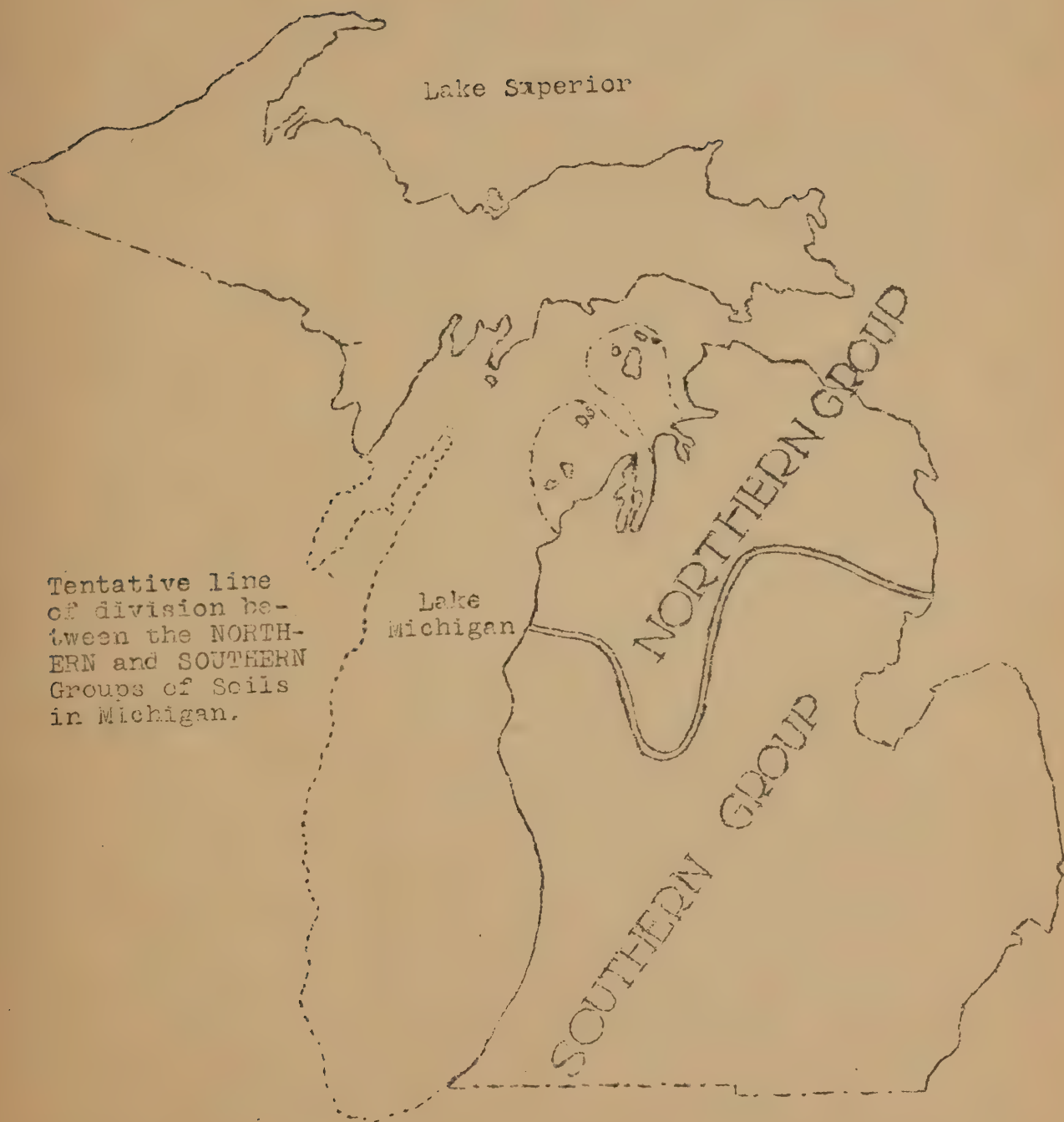
Horizon	SiO ₂	FeAl	Sum bases	CaO	N	pH	Heat Wetting*	Unfree Water Per cent	Silt Clay	Soil Description
1	86.38	2.41	2.14	.34	.24	4.82	109.32	2.7	:	Sand - good
2	89.28	4.88	2.18	.44	.05	4.43	49.96	1.4	:	drainage
3	91.92	4.74	1.92	.49	.02	5.33	20.53	0.8	:	Coloma
4	92.96	4.67	2.15	.46	.00	4.94	17.29	0.8	:	Berrien County
1	90.47	6.09	3.07	.98	.17	6.73	94.25	2.2	:	Sand - good
2	92.73	6.15	2.25	.61	.03	5.93	50.62	.9	:	drainage
3	92.98	5.83	2.47	.65	.02	5.93	37.58	.7	:	Ottawa
4	92.27	4.53	2.36	.49	.01	5.92	24.17	1.1	:	Scottville
1	88.15	3.83	1.67	.49	.10	5.60	62.62	1.6	:	Sand - good
2	92.99	3.78	1.64	.34	.04	4.58	38.54	1.3	:	drainage
3	91.97	4.38	2.01	.38	.03	4.65	40.55	1.1	:	Plainfield
4	96.22	4.09	1.85	.42	.00	4.94	17.90	1.1	:	Grayling
Sub					.01	5.63	10.39	0.4	:	
1	78.51	9.14	3.59	1.08	.27	6.32			:	Loam - good
2	80.78	9.52	3.49	.76	.05	5.43			:	drainage
3	77.91	12.95	3.80	.91	.03	5.19			:	Bellefontaine
4	76.39	14.19	3.92	.98	.01	5.33			:	Kalamazoo

* Calories of heat produced per 50 grams of soil.

Northern Group

Horizon	SiO ₂	FeAl	Sum bases	CaO	N	pH	Heat Wetting*	Unfree water	Silt clay	Soil Description
1	85.50	2.49	1.53	0.59	.28	5.60	153.0	3.3	:	:
2	94.92	1.59	1.24	.24	.02	4.58	20.6	.8	:	:
3	90.40	4.39	1.94	.32	.07	4.65	69.8	1.5	:	:
4	89.88	4.42	2.15	.46	.05	4.94	59.8	1.2	:	:
Sub					.00	5.63			:	:
1	74.69	4.30	2.02	0.63	.47	5.06	155.35	4.5	:	:
2	93.34	2.35	1.61	0.27	.01	4.82	14.82	.7	:	:
3	86.64	5.24	2.71	0.36	.06	4.48	140.08	1.4	:	:
4	89.97	2.97	2.62	0.28	.01	4.82	28.87	.8	:	:
Sub						5.28			:	:
1	68.04	6.16	2.78	2.24	.65	7.46			:	:
2	86.96	4.41	3.09	.62	.04	6.41	48.13		:	37.5
3	86.18	6.17	2.87	.69	.04	5.14	62.14		:	21.7
4	69.59	8.53	8.58	6.22	.03	7.47	65.05		:	30.5
Sub					.02	8.25	28.83		:	25.7

* Calories of heat produced per 50 grams of soil.



Lake Superior

Tentative line
of division be-
tween the NORTH-
ERN and SOUTHERN
Groups of Soils
in Michigan.

Lake
Michigan

NORTHERN GROUP

SOUTHERN GROUP

DISCUSSION

Physical and Chemical Investigations on Several Soil Types of
Michigan - M. M. McCool.

Dr. Marbut -

"I am very glad indeed to see that work done. I think that is the first work of the kind to be done in the United States. I am also very glad to get this division line between the northern and southern groups of soils in Michigan."

THE CONDITION OF SOIL SURVEY WORK IN RUSSIA TOWARD THE BEGINNING
OF THE YEAR OF 1923

By Prof. N. M. Tulaikov, President of The Russian Institute of
Experimental Agronomy.

The question of necessity of studying the soil layer of Russia was first raised in the middle of the 19th century, and a certain portion of the work in this direction was made, basing on the data of various kinds of statistical and economic investigations that were available at the time. The question of soil survey in Russia attracted the foremost interest, so far as scientific soil investigations are concerned, after the study of Russian chernozem by Prof. V. V. Dokuchaeff, who was the first one to make an exceptionally thorough study of this most important soil type. In the eighties of the last century, Prof. Dokuchaeff was invited by Nijnegorodsky Zemstvo to make a soil survey of Nijnegorodsky province. This work, classical in its value, from all points of view, made it possible to prepare a group of the most noted soil men in Russia (Professors Sibirtseff, Ototsky, Zemiatchensky, etc.) who later founded the so-called "Dokuchaeff school of soil investigations".

These men have done a tremendous amount of soil survey in the spirit of this school and played a very important role in the development of the soil survey in Russia. The basic thesis of the work of this school among Russian soil survey men consists in the thought that soil is a natural formation, which in its characteristics reflects all those natural conditions in which the formation took place. Taking for a basis a fact that the distribution of soils over the Russian plains so well coincides with the geological, climatic, and topographical peculiarities and the age of each region, Prof. Dokuchaeff and his followers, especially Prof. Sibirtseff, have developed a natural classification of soils of European Russia. (The basic idea of this classification, as well as the classification itself, was discussed by the author in an article in the Journal of Agricultural Science, Vol. 3, p. 1, pp. 80-85). This classification was afterwards adopted in all soil survey work and gave a large amount of data for further investigation and also for the development and the perfection of this classification.

The soil survey of Russia shows that, different in their characteristics, soils are situated in European Russia in the form of wide belts running from the west towards the east in the latitudinal direction and to a certain extent in parallel with the natural vegetation in European Russia. The extreme north portion of European Russia is occupied by tundra with the ever frozen subsoil, capable to support but a scanty northern vegetation and having practically no agricultural value. Further toward the south, in the forest region of northern Russia, lie northern podzols of morainal origin, which still further towards the south grade themselves into chernozem. Chernozem spreads as a wide belt, having the after-morainal loess for a subsoil. It has a characteristically prairie vegetation and by itself characterizes the Russian plains (prairies). In the extreme south and especially in the south-eastern portion of European Russia, chernozem changes into soils with smaller amounts of humus and with greater amounts of easily soluble salts. These are light gray soils of dry prairies and deserts.

Of course, these basic types of soils of Russian plains are united by a multitude of transitional formations that characterize the respective transitional conditions of their formation - the types from which they originated, topography of the region, etc.

On further and more detailed study each soil type is subdivided according to its mechanical composition into a series of variations of heavier types or clay soils and lighter types or sandy soils, with all possible gradations between these two extremes.

In the eastern portion of European Russia, several provinces were surveyed by Prof. Rizpolojensky of Kazan University, who applied a somewhat different soil classification, but the area of this kind of soil survey is relatively small.

In 1901, the Department of Agriculture published a soil map of European Russia, making for a basis the data available at the time. The map was prepared under a supervision of Prof. Sibirtseff and Ferhlit, using Prof. Sibirtseff's classification and having a scale of 60 verst to one inch. (One English mile equals approximately 1.5 verst). This soil map has played a very important role in studying and in evaluation of soils of European Russia. Soon after this, partly due to the enactment of a law regarding the evaluation of lands for the purpose of a more correct property taxation, many local Zemstvos began a systematic and detailed soil survey in different provinces of Russia and during the period between 1903 and 1914 soil survey covered a greater portion of the territory of European Russia.

A wave of immigration to Siberia caused Russian scientists to start investigations of soils of the vast Siberian territories. The soil survey proper was started in Siberia in 1908 by Prof. Glinka and was stopped just before the war. The soil survey in Siberia has been done, not on the whole Siberian territory, but only in many specially selected regions of some agricultural importance. This soil survey made it possible for Prof. Glinka to make a schematic soil map of Siberia which was printed in connection with his well known book on "Soils".

The soil survey of European Russia was made in detail, relatively speaking, and the soil maps were prepared, depending on the degree of accuracy, with the scale of 3 versts to the inch, sometimes 2 versts to the inch and even 1 verst to an inch, (Chernigov province). Often the survey was not of a very detailed character and the scale of mapping was as small as 10 verst to one inch. At the present time nearly the entire area of European Russia, with the exception of tundra and the northern forest area, is surveyed, and all of this vast amount of material is being classified and unified in the preparation of a new soil map of European Russia, in which case the scale to be used 1/1,000,000, i. e. approximately 23 versts to an inch (the scale adopted for the publication of maps in accordance with the international agreement). This work is being done in cooperation by Dokuchaeff's Soil Committee, Soil Committee at Russian Academy of Science, and other scientific institutions and individual soil survey men, under whose supervision the soil survey has been done in various provinces. The map will be completed in the very near future. It will summarize the soil survey in European Russia and give a better and up to date picture of Russian soils, distributing the different soil types over the Russian territory.

Besides the general soil map mentioned above, Prof. Prasoloff, Director of the Bureau of Soils of the Agricultural Scientific Committee, has prepared a map of soil regions (scale 60 verst to one inch). This map shows not the individual soil types, but only a combination of soil types with the similar characteristics as to climate, topography and vegetation. The map is accompanied by a description of those regions as to their geographic character, composition of soils, their character, agricultural value, etc. An estimate is made of the total area of each regional type and other valuable material is included that gives a general outlook on the soil peculiarities of a given region. This work is ready for publication but it is not yet published.

There are two main agencies for the geographic study of Russian soils, namely: Dokuchaeff Soil Committee in Petrograd, and Moscow Soil Committee in Moscow. Each of these committees in these two most important Russian centers has on its staff several soil survey men with numerous field assistants. The same general program is followed by both institutions and the same general methods are employed by both in field and laboratories. Each institution is supported by the Government, at whose request, for instance, the entire soil survey in Siberia was made by the Dokuchaeff Soil Committee. Each committee has laboratories for both physical and chemical soil analysis and each institution has published a soil journal. Dokuchaeff Soil Committee has published a journal, "Soil Science" (Pochvovedenie) since 1900 to 1914. The publication ceased at the beginning of the war and has not yet been renewed. The Moscow Soil Committee is publishing a journal, "Russian Soil Man" which was stopped during the war, but made its appearance again during 1922. (The author brought several recent issues to this country for Dr. J. G. Lipman, as an editor of Soil Science).

Before the war Russian soil survey men had held several national and local conferences for the discussion of questions pertaining to the methods of soil survey both from theoretical and technical points of view in order to further unify the procedure of the soil survey. In the fall of 1921 in Moscow, a third national conference of soil survey men took place where several very important questions were discussed in connection with the continuation of the soil survey in the newer regions. The question of publishing a new soil map was discussed at the meeting. Also a question was raised regarding the more systematic soil investigations of different soil types at different experiment stations in order to establish a connection between the various soil types and their agricultural values.

A clear and logical dependence between the natural conditions and the soil types found under those conditions, which is so well revealed in the soils of Russian plains, made it possible to develop a very simple and yet scientific soil classification that was adopted by other countries (for instance Roumania). It would be very interesting and important in order to develop a general and natural classification of soils of the entire surface of the earth that another great country, namely, the United States of America, would take a more active part in critically studying the Russian soil classification as well as the general literature on soil investigations in Russia. There are many reasons for the thought that there is a very great similarity between the soils of Russia and those of the United States, for in their modification from the natural soil conditions, man has accomplished relatively but little. The parallelism between soils of the United States and those of Russia is evident to every one who is more or

less familiar with this kind of work, and we may hope that by the cooperative efforts of American and Russian soil survey men it would be possible to develop such a soil classification that would be adopted by science in general, similarly to classifications of plants and animals which are used by all workers in zoology or botany.

The corner stones of this classification, it seems to me, have been laid already by some soil scientists. It remains for all soil investigators, submitting all available data to a thorough analysis and investigation, cooperatively to further this work to the fullest extent that is made possible by the available materials on this subject. The role of American and Russian soil investigators in this respect will naturally be the greatest, and to their lot it may fall the honor of being the pioneers in developing a scientific soil classification.

Progress of Soil Survey in Ontario.

By Prof. R. Marcourt, Ontario Agricultural College.

Work was commenced in the reconnaissance survey of the soils of the older part of the Province in the summer of 1914. The work was continued with many interruptions and changes in the surveying staff due to the war, during the next four years. In 1919 we succeeded in completing the survey and gathering up all the loose ends due to the interruptions, but unfortunately the man who did the final work fell a victim to the "Flu" before he had a chance to write up the work. From his notes and maps we have prepared our first publication and this is now practically ready for publication.

During the summers of 1920 and 1921 no survey work was done, as it was impossible to secure a trained man for the work. This season we were able to start the detail, survey and we intend to develop the work as fast as we can.

Based on our reconnaissance survey we have laid out three experimental plots on three of the larger series of soils. From one of these we have had five crops, another three crops, and the third was only got under way the past season.

As will be seen our work has been very much broken, but we hope to make better progress in the future.

SECRETARY'S REPORT

AMERICAN ASSOCIATION OF SOIL SURVEY WORKERS.

From November 19, 1921 to November 17, 1922.

The activities of the Association during the past year have been directed chiefly to the publication of Bulletin No. 3 which was a report of the second annual conference of the Association held at East Lansing, Michigan, November 18 and 19, 1921. This report consisted of ninety-one pages and three hundred complete copies were issued. The Secretary wishes to state that the stencils for this report were all cut by the office of the U. S. Bureau of Soils at Washington, D. C., and the paper, mimeograph machine, labor and etc., in running off the copies were supplied by the University of Wisconsin, College of Agriculture. For all of this work and service there was no charge made. The copies of the Bulletin were mailed out in March 1922 to all members and to about one hundred fifty others who are interested in our work.

Two hundred copies of Bulletin No. 2 were sold to the Oklahoma Agricultural College and several other small shipments of from ten to fifty each were made to other soil workers who were not previously supplied. The Secretary still has on hand about twelve hundred copies of Bulletin No. 2. It has been our practice to supply without cost about one hundred copies of these to Colleges desiring them; where more than this number are desired, we have been quoting a price of \$3 per hundred or \$25 per thousand.

MEMBERSHIP

At the time of the annual meeting in 1921 there were one hundred thirty-six members. At the present time the Association has one hundred sixty-eight members and these are distributed among thirty-five states and nine Canadian provinces, in addition we have one member in the Philippine Islands and one member in India. We also have a request from a soil worker in Norway asking if he is eligible for membership. A soil worker in Australia has shown much interest in our Association and may wish to become a member. The Secretary wishes to suggest that the Association should take some action relative to admitting workers from foreign countries to membership in the Association.

THE AMERICAN ASSOCIATION OF SOIL
SURVEY WORKERS.

(Signed) W. J. Geib.

Approved Nov. 17, 1922.

Secretary-Treasurer.

TREASURER'S REPORT

AMERICAN ASSOCIATION OF SOIL SURVEY WORKERS COVERING

THE YEAR NOV. 19, 1921 to NOV. 17, 1922.

RECEIPTS:

1921	
Nov. 19. Balance on hand from 1920	\$49.02
Nov. 19. Dues for 1922 collected prior to this date.	<u>68.00</u>
Nov. 19 Total cash on hand	\$117.02
Nov. 19-21 to Nov. 1-22. Additional dues for the year 1922	<u>76.30</u>
Total	\$193.32

EXPENDITURES:

	Voucher	
Nov. 30-21. Printing on badges	1	\$ 4.00
Nov. 30 Zinc etching "	2	2.82
Mar. 16-22 Stapling Reports	3	5.00
Mar. 18-22 Zinc etching	4	5.10
June 6 Binding annual Reports	5	1.50
Aug. 14 Stamps	6	15.00
Oct. 10 Stenographic work		2.50
Oct. 21 Stamps	7	14.51
Oct. 22 Zinc etching-programs	8	2.50
Oct. 23 Printing programs	9	23.00
Nov. 12 Telegrams		<u>2.30</u>
Total		78.23

Total receipts for 1922	\$ 193.32
Expenditures	<u>78.23</u>
Balance on hand for 1922	\$ 115.09
Dues collected for 1923	46.00
Total amount in Treasury on Nov. 17, 1922	\$ 161.09

Money outstanding. Sold to Oklahoma Agri. College 200 copies of Bul.
No. 2 at \$3.00 per 100 total due \$6.00

THE AMERICAN ASSOCIATION OF SOIL
SURVEY WORKERS.

(Signed) W. J. Gibb.
Secretary-Treasurer.

MINUTES OF THE BUSINESS MEETING OF THE AMERICAN ASSOCIATION OF SOIL
SURVEY WORKERS
HELD AT URBANA, ILLINOIS, NOVEMBER 17 & 18, 1922.

The meeting was called to order by President Wianko in the Union Building at Urbana, Illinois, Friday night, Nov. 17, 1922.

Minutes of the previous meeting held at East Lansing, Michigan were read and approved.

Report of the Secretary-Treasurer read and accepted.

The Steering Committee of which M. F. Miller was chairman nominated the following officers for the coming year: President, F. J. Alway; Vice-President, M. M. McCool; Secretary-Treasurer, A. M. O'Neal.

The Secretary was instructed by vote of the Association to cast the unanimous ballot of the conference for the officers nominated. Those nominated were declared elected.

The Committee recommended that the new President continue all standing committees with such changes as seem desirable. Following the action of the Association, they recommended that the Committee on Soil Maps and Reports be made into two Committees, one on Soil Reports and one on Soil Maps and that a new committee on Terminology be appointed.

The Committee recommended that the next meeting consider the following subjects:

1. The relation of our Soil Survey to Land Classification.
2. Methods of Sampling.
3. Relation of Soil Acidity Tests to Classification.
4. It suggests the policy of encouraging the development of experimental fields by soil tests.
5. It recommended that the Association should encourage the more intensive work in the individual states regarding "Characteristics of Soil Profile".

The time and place of the next meeting were left to be decided by the Executive Committee in the hope that the Agronomy Society might meet at some point in the Central West so that the Soil Association might meet at the same place.

The Committee on Resolutions consisting of G. E. Condra and P. E. Brown presented their report relative to the death of Professor Mosier. The motion was made that these resolutions be spread on the Minutes of the Association and that copies be sent to the bereaved family and to the University of Illinois.

The Association paused in its deliberations to pay silent tribute to the

memory of Dr. C. G. Hopkins.

The Association went on record as favoring the Temple Bill which is now pending before Congress and which provides for topographic maps which will complete the United States in about twenty years. The Association urged that the individual members of the Association take such action as they could in informing their Congressmen of the importance of having this work completed earlier. The Secretary was instructed to notify the Federal American Engineering Society at 26 Jackson Place of the action of the Association.

The Association expressed appreciation to Miss Nagel for her splendid work in taking stenographic record of the various discussions. She was presented with a three pound box of candy by the Secretary for the Association.

Action was taken by the Association showing their keen appreciation for the generous hospitality and the splendid reception given the Association by the University of Illinois and especially to Dean Mumford and the officers and members of the Agronomy Department.

Friday evening at 6 o'clock the members of the Agronomy Department entertained the delegates to the Conference at an elaborate banquet at the Inman Hotel. Dean Mumford was a guest of honor and Professor Burleson acted as toastmaster. Following the banquet the Association gave three cheers for the University of Illinois Department of Agronomy and all of its members in appreciation for the splendid banquet they gave.

Prior to the holding of the business meeting there were a number of committee reports which were read as a part of the regular program. Action was taken by the Association concerning these various reports and a record is hereby given of this business which was transacted.

Following the address by Professor Miller, Dr. Condra made a motion to the effect that the Association should urge that all original material, notes, etc., should be filed in a fire proof vault either in Washington or in the several states as seems best and thus permanently preserved for future use.

The report of the Committee on Color Standards which was read by J. G. Hutton was accepted. The Committee was thanked for their splendid work and they were asked to continue.

The report of the Committee on Publicity read by Dr. P. E. Brown was accepted.

In the absence of the chairman of the Committee on Legislation no report was presented.

The report of the Committee on the Improvement of Soil Maps and Reports read by W. J. Geib was accepted and action was taken favoring the splitting of this committee into two committees, one for the improvement of Soil Maps and the other for the improvement of Soil Reports.

The report of the Committee on Correlative Laboratory Work was read by G. W. Conroy. The report was accepted and the Committee continued.

The report of the Committee to consider the question of association with the Agronomy Society was read by Prof. M. F. Miller and accepted.

The report of the Committee on Organic Soils was read by Dr. F. J. Alway. The report was accepted and the Committee continued.

The Association went on record as being in favor of having an additional Committee on Terminology.

OFFICERS AND COMMITTEE ASSIGNMENTS FOR 1923.

OFFICERS:

Pres. - F. J. Alway
V. Pres. - M. M. McCool
Sec.-Treas. - A. M. O'Neal

COMMITTEES:

Color Standards:
J. Gladden Hutton
Thos. D. Rice
A. M. O'Neal

Information and Publicity:
C. F. Shaw
W. E. Hearn
W. H. Stevenson

Legislation:
G. E. Condra
M. F. Miller
P. E. Brown

Improvement in Soil Maps:
W. J. Geib
T. D. Rice
J. O. Veatch

Improvement in Soil Survey Reports:
P. E. Brown
H. H. Krusekopf
A. T. Wiancko
A. R. Whitson

Correlative Laboratory Work:
G. W. Conrey
M. M. McCool
R. S. Smith
Roy Hansen

Committee on Change of Name, Field of Association and
Affiliation with Agronomy Society.

M. F. Miller
Robt. Harcourt
C. F. Marbut
R. S. Smith

Terminology
C. F. Marbut
G. E. Condra
H. L. Walster

Classification of Organic Soils

H. H. Bennett

M. M. McCool

R. S. Smith

W. J. Geib

S. D. Conner

Chas. F. Shaw

C. B. Clevenger

MEMBERS AND FRIENDS OF THE AMERICAN ASSOCIATION OF SOIL SURVEY WORKERS
ATTENDING THE 1922 CONFERENCE, URBANA, ILLINOIS.

1	F. J. Alway	St. Paul, Minn.
2	B. W. Tillman	Bellville, Ill.
3	H. H. Krusekopf	Columbia, Mo.
4	J. E. Adams	LaFayette, Ind.
5	W. E. Tharp	Washington, D. C.
6	E. W. Knobel	" "
7	Mrs. A. T. Sweet	Neosha, Mo.
8	A. T. Sweet	" "
9	H. G. Lewis	Ithaca, N. Y.
10	W. E. Hearn	Washington, D. C.
11	Thos. D. Rice	" "
12	H. H. Bennett	" "
13	A. T. Wiancko	LaFayette, Ind.
14	J. G. Hutton	Brookings, S. D.
15	A. E. Taylor	Findley, Ohio.
16	H. L. Walster	Agric. College, N. D.
17	T. H. Benton	Ames, Iowa.
18	H. V. Jordan	Columbia, Mo.
19	A. L. Patrick	State College, Pa.
20	C. F. Marbut	Washington, D. C.
21	G. W. Conrey	Columbia, Mo.
22	M. H. Lapham	Berkeley, Cal.
23	A. M. O'Neal	Ames, Iowa.
24	L. R. Schoenmann	Lansing, Mich.
25	C. Lounsbury	Washington, D. C.
26	P. R. McMiller	Minneapolis, Minn.
27	P. E. Brown	Ames, Iowa.
28	W. M. Senstius	Chicago, Ill.
29	E. C. Hall	105 W Monroe St., Chicago, Ill.
30	A. T. Higgins	Sullivan, Ill.
31	C. B. Manifold	Washington, D. C.
32	W. P. Hiltebrand	Urbana, Ill.
33	D. C. Wimer	" "
34	A. L. Price	Chicago, Ill.
35	E. H. Bailey	Madison, Wis.
36	A. R. Albert	" "
37	E. D. Fowler	Fairmont, Ind.
38	C. A. Stanton	Columbus, Ohio.
39	C. B. Clevenger	Winnepeg, Canada.
40	Wm. B. Cobb	Baton Rouge, La.
41	J. A. Elwell	Washington, D. C.
42	D. S. Gray	Ames, Iowa.
43	A. L. Gray	Washington, D. C.
44	M. F. Miller	Columbia, Mo.
45	J. O. Veatch	East Lansing, Mich.
46	Robt. Wildermuth	Bangor, Maine.
47	F. J. O'Connell	Lansing, Mich.
48	M. J. Edwards	Madison, Wis.
49	C. W. D. Parsons	Central Sci. Co., Chicago, Ill.
50	G. E. Condra	Lincoln, Neb.
51	H. S. Grindley	Urbana, Ill.

52	T. E. Richmond	Urbana, Ill.
53	G. L. Fuller	Theresa, N. Y.
54	W. T. Carter, Jr.	Washington, D. C.
55	E. E. DeTurk	Urbana, Ill.
56	F. C. Bauer	" "
57	M. A. Hein	" "
58	E. A. Norton	" "
59	B. B. Clark	" "
60	R. G. Crammond	" "
61	W. H. Meyer	" "
62	A. H. Sears	" "
63	A. L. Lang	" "
64	H. J. Snyder	" "
65	R. P. Thomas	" "
66	C. J. Badger	" "
67	J. Lamb	" "
68	A. U. Thor	" "
69	H. G. M. Jacobson	" "
70	W. B. Harland	" "
71	C. A. Morrison	" "
72	J. W. Coale	" "
73	M. I. Wolkoff	" "
74	M. M. McCool	East Lansing, Mich.
75	W. H. Mumford	Urbana, Ill.
76	W. J. Geib	Madison, Wis.
77	O. J. Ellis	" "
78	F. A. Wyatt	Univ. of Alberta, Edmonton, Alberta.
79	A. H. Hawkins	Saskatoon, Saskatchewan.
80	R. Hansen	" "
81	S. D. Averett	Ky. Ex. Sta., Lexington, Ky.
82	W. L. Slate, Jr.	Conn. Exp. Sta., New Haven, Conn.
83	Mrs. R. S. Smith	Urbana, Ill.
84	Miss Sybil Nagle	" "
85	J. P. Seaton	LaFayette, Ind.
86	T. M. Bushnell	" "
	G. Thomason	(Thomson Phosphate Co.) Chicago, Ill.
	S. O. Perkins	Washington, D. C.
	A. C. Anderson	" "
90	S. D.	" "
91	L. H.	LaFayette, Ind.
92	F. H. Crane	Urbana, Ill.
93	R. A. Scott	Champaign, Ill.
94	G. E. Hall	" "
95	F. W. DeWolf	Manhattan, Kan.
96	C. H. Pathont	(State Geological Survey) Urbana, Ill.
97	C. M. Linsley	(Champaign Co. Farm Adv.) " "
98	F. W. Gault	Kankakee, Ill.
99	L. E. Rust	Urbana, Ill.
100	M. J. Plice	" "
101	R. A. Smith	Purdue, Ind.
102	A. C. Chapman	Lansing, Mich.
		Urbana, Ill.

THE LIBRARY OF THE
FEB 23 1938
UNIVERSITY OF ILLINOIS

